PB90-115973

Superfund Record of Decision (EPA Region 5): Midco II, IN (First Remedial Action), June 1989

(U.S.) Environmental Protection Agency, Washington, DC

30 Jun 89

U.S. Department of Commerce
National Technical Information Service
NTIS

PB90-115973

United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R05-89/093
June 1989

EPA

Superfund Record of Decision:

MIDCO II, IN

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First Remedial Action - Final

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16. Abstract (Limit: 200 words)

The MIDCO II site is a seven-acre storage and disposal facility in Gary, Indiana. The surrounding area is predominantly used for industrial purposes, and includes 34 other potential hazardous waste sites. The underlying aquifer is highly susceptible to contamination from surface sources because of the high water table; however, in the vicinity of the site, the aquifer is used primarily for non-drinking water purposes. The same operator as at another Superfund site, MIDCO I, began waste operations, including drum storage at MIDCO II during the summer of 1976. Following a major fire at the MIDCO I site in January 1977, MIDCO transferred the operations from the MIDCO I site to the MIDCO II site. Operations included temporarily storing bulk liquid and drum wastes; neutralizing acids and caustics; and disposing of wastes by dumping wastes into onsite pits, which allowed wastes to percolate into the ground water. One of these pits, the filter pit, had an overflow pipe leading into a ditch, which drained into the nearby Grand Calument River. By April 1977 approximately 12,000 to 15,000 55-gallon drums of waste materials were stored onsite. Additionally, an estimated ten badly deteriorated and leaking tanks were holding wastes including oils, oil sludges, chlorinated solvents, paint solvents, paint sludges, acids, and spent cyanides. In August 1977 a fire at the site destroyed 50,000 to 60,000 drums. Although most drums (See Attached Sheet)

17. Document Analysis a. Descriptors
Record of Decision - MIDCO II, IN
First Remedial Action - Final
Contaminated Media: soil, sediment, and gw
Key Contaminants: VOCs (benzene, toluene, TCE, xylenes), other organics, (PCBs), metals (arsenic, chromium, lead)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement

19. Security Class (This Report) None

20. Security Class (This Page) None

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22. Price

(See ANSI-Z39.18)

See Instructions on Reverse

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EPA/ROD/R05-89/093
MIDCO II, IN
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16. Abstract (continued)

were badly damaged a substantial number of drums, including 75 to 100 drums containing cyanide, survived the fire. EPA conducted a preliminary investigation resulting in the installation of a 10-foot high fence around the site. In 1984 and 1985 EPA conducted emergency removal activities including repairing and extending the site fence; removing most of the remaining drums, tanks, and debris from the site's surface; and removing the sludge pits and filter pit contents. The resulting PCB-contaminated soil pile was removed and disposed of in an offsite hazardous waste landfill in early 1986, and most of the cyanide-contaminated pile was also removed. Removal activities ended in January 1986. The primary contaminants of concern currently affecting the soil, sediment, and ground water are VOCs including benzene, toluene, TCE, and xylenes; other organics including PCBs; and metals including arsenic, chromium, and lead.

The selected remedial action for this site includes excavation and treatment of 35,000 yd^3 of contaminated soil and waste materials using solidification/stabilization followed by onsite disposal; excavation and onsite solidification/stabilization of 500 yd^3 of contaminated sediment; covering the site in accordance with RCRA landfill closure requirements; ground water pumping and deep well injection in a Class I well if EPA grants a petition to allow land disposal of waste prohibited under RCRA; if a petition is not approved, ground water will be treated using air stripping and a liquid phase granular activated carbon polish system to meet EPA requirements (LDR treatment standards), followed by deep well injection or reinjection into the aquifer; ground water monitoring; and implementing deed and access restrictions. The ground water treatment and underground injection portions of the remedial action may be combined with the remedial action for MIDCO I. The estimated present worth cost for the remedial action is $18,596,400, which includes annual O&M cost of $733,000, if ground water is treated; or $14,419,000, which includes annual O&M costs of $301,000, if ground water is not treated.

1.a

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DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Midco II
Gary, Indiana

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Midco II site in Gary, Indiana, developed in accordance with CERCLA, as amended by SARA, and, to the extent practicable, the National Contingency Plan. This decision is based on the administrative record for this site. The attached index identifies the items which comprise the administrative record upon which the selection of the remedial action is based.

The State of Indiana is expected to concur with the selected remedy.

DESCRIPTION OF THE SELECTED REMEDY

This is the final remedial action for the Midco II. A surface removal action including removal and off-site disposal of wastes in drums and subsurface materials in the former sludge pit and filter bed has been completed by U.S. EPA. The final remedial action will treat the highly contaminated subsurface soils and materials that remain at the site and that are contributing to ground water and surface water contamination near the site, and will treat the highly contaminated ground water near the site. These actions will address the principal threats posed by the site which include public health risks due to future development of the site, public health risks due to off-site migration of ground water, environmental impacts on the ditch northeast of the site and down-stream wetlands.

The major components of the selected remedial actions include:

- On-site treatment of an estimated 35,000 cubic yards of contaminated soil and waste material by solidification/stabilization followed by on-site deposition of the solidified material. The solidification/stabilization operation will be considered successful if it reduces the mobility of contaminants so that leachate from the solid mass will not cause exceedance of health based levels in the ground water.

- Excavation and on-site solidification/stabilization of approximately 500 cubic yards of contaminated sediments in the ditch adjacent to the northeast boundary of the site,

- Installation and operation of a ground water pumping system to intercept contaminated ground water from the site;

- Installation and operation of a deep, class I, underground injection well for disposal of the contaminated ground water; of if a no-migration demonstration is disapproved by U.S. EPA, installation and operation of a treatment system for the contaminated ground water to remove hazardous substances followed by deep well injection of the salt contaminated water; or installation and operation of a treatment system for the contaminated ground water to remove hazardous substances followed by reinjection of the salt contaminated ground water into the Calumet aquifer in a manner that will prevent spreading of the salt plume.

- Installation of a conduit in the ditch along the site and a final site cover satisfying RCRA closure requirements, if applicable or if considered relevant and appropriate (the quality of cap required will depend on the results of tests on the solidifed material;

- Restriction of site access and imposition of deed restrictions as appropriate;

- Related testing and long term monitoring.

The groundwater treatment and underground injection portions of the remedial action may be combined with the remedial action for Midco I. In this case, the combined treatment constitutes an on-site action, for purposes of the Off-site Policy and for compliance with the requirements of the Resource Conservation and Recovery Act.

DECLARATION

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate to this remedial action and is cost-effective. This remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility or volume as a principal element and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

Because this remedy will result in hazardous substances remaining onsite above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Valdas V. Adamkus.

Signature of Regional Administrator

Date June 30th, 1989.

RECORD OF DECISION SUMMARY

MIDCO II, GARY, INDIANA

I. SITE NAME, LOCATION AND DESCRIPTION

The Midco II site is located at 5900 Industrial Highway (U.S. Route 12), in Gary, Indiana (Figure 1). It is in the northwest quarter of Section 36, Township 37 North, Range 9 west. This is predominantly an industrial area, where 34 other potential hazardous waste sites have been identified. There are few residential homes, with the nearest residence about 1 mile to the southeast. Also, there are remnant natural area and wetlands in the vicinity as well as areas of undeveloped land southeast of Midco II.

The site covers approximately 7 acres of level sandy soil and fill situated on the Calumet Lacustrine Plain. It is midway between Lake Michigan and the Grand Calumet River, which also flows into Lake Michigan. It is 1.14 miles south of Lake Michigan and 3/4 of a mile north of the Grand Calumet River.

Midco II is bordered by an auto salvage yard on the northwest, a ditch and the Conrail Railroad right-of-way on the northeast, vacant private land on the southeast, and Industrial Highway on the southwest. The Gary City Airport is located on the other side of Industrial Highway. The ditch along the northeast side of the site flows into the Grand Calumet River.

Topography:

The original relief of this site, as well as the surrounding area, included alternating east and west trending, ridges and swales. However, the topography of the site, as well as the surrounding area, has been extensively modified by man and is only locally preserved. The site itself is now relatively flat and is underlain by fill material and sand. Since a surface removal action has been completed, the remaining contaminants of concern are in subsurface soils and materials, and the ground water.

Ecology:

There are a number of relatively undisturbed, state-designated nature preserves within a three-mile radius of the site. These areas as well as other relatively undisturbed sites, provide habitat for a wide variety of migratory and resident wildlife. The southern end of Lake Michigan and nearby habitats are a convergence area for migratory birds following the north-south boundary of the Lake.

Wetland vegetation exists in the ditch that is adjacent to the northeast border of Midco II. Mallard broods were observed in this ditch. The mallard has been designated as a Species of Special Emphasis by the U.S. Fish and Wildlife Service. Midco II is also within the range of the Federally-endangered Indiana bat. In addition, Blanding's turtle, a State of Indiana-designated endangered species was observed near Midco II.

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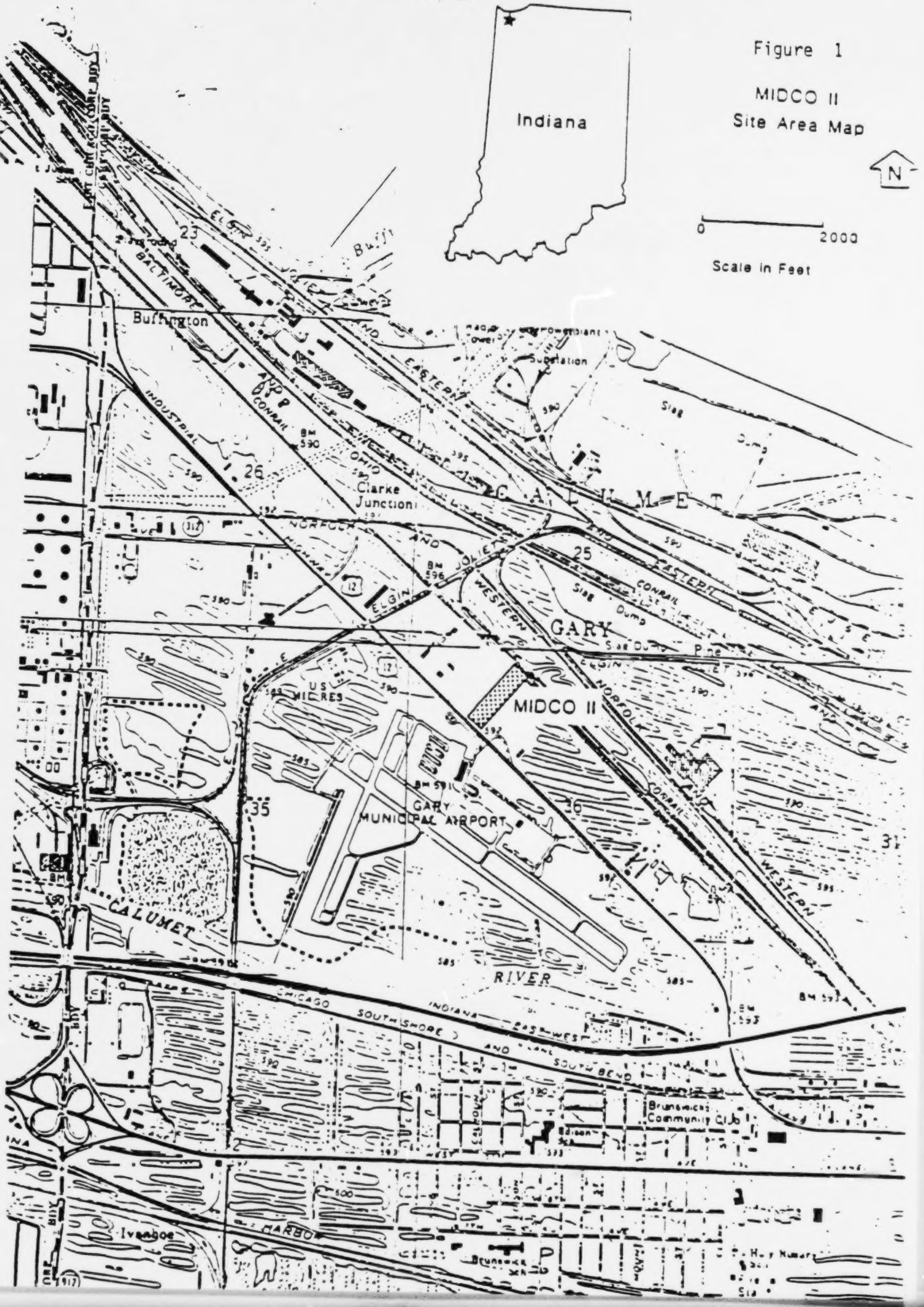
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WESTERN
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Slag Dump
Substation
MIDCO II
US
HI CRES
GARY
MUNICIPAL AIRPORT
CALUMET
RIVER
CHICAGO
SOUTH SHORE
AND
SOUTH BEND
INDIANA
EAST-WEST
Brunswick Community Club
Edison Sch
Ivanhoe
HARBOR
Brunswick Sch
23
25
26
35
36
31
312
12

Figure 1

MIDCO II
Site Area Map

rinted from "Remedial Investigation of Midwest Waste Disposal Company, Inc. (Midco II), Gary, Indiana"
y Environmental Resources Management-North Central

Rabbits, robins and red-winged black birds, crayfish and snapping turtles were also observed near the site.

Ground water:

The surficial sand aquifer (Calumet aquifer) at the Midco II site extends to a depth of 45 to 50 feet beneath the site. Historically, the Calumet aquifer was an important ground water source but current aquifer use in the vicinity of the Midco II site is limited. The Calumet aquifer is very susceptible to contamination from surface sources because of the high water table in the area and the very permeable sandy nature of the surface soils. At a boring on the airport property, 62 feet of soft silty clay and silty clay loam were encountered beneath the Calumet aquifer overlying as much as 6 feet of hard, silty till. Available test data suggest that the bedrock aquifer beneath the site contains abundant petroleum hydrocarbon. The boring penetrated about 40 feet of heavy oil-saturated vugular dolomite.

Figure 2 indicates the ground water flow in the Calumet aquifer at the site. A subtle but persistent ground water high runs east and west through the center of the site. Below the northeast part of the site, the ground water migrates northeast into the adjacent ditch. Below the southwest part of the site, the ground water migrates south under the Gary City Airport and eventually into the Grand Calumet River. Because of the very low ground water gradient, the estimated velocity of the ground water is only 21 feet per year to the northeast and 16 feet per year to the south. The estimated ground water flow rate through the clay confining layer below the Calumet aquifer is 3 feet per year.

The predominant source of water for both potable and non-potable uses in the Midco II area is Lake Michigan. The well inventory conducted in the Remedial Investigation identified 14 wells within one mile of the site. Three are bedrock wells used by local businesses and the airport for non-drinking purposes. Eleven are screened in the Calumet aquifer. Nine of these are used by local businesses for non-drinking purposes, and two are residential wells that are no longer in use, although they were previously used for drinking.

Surface Drainage

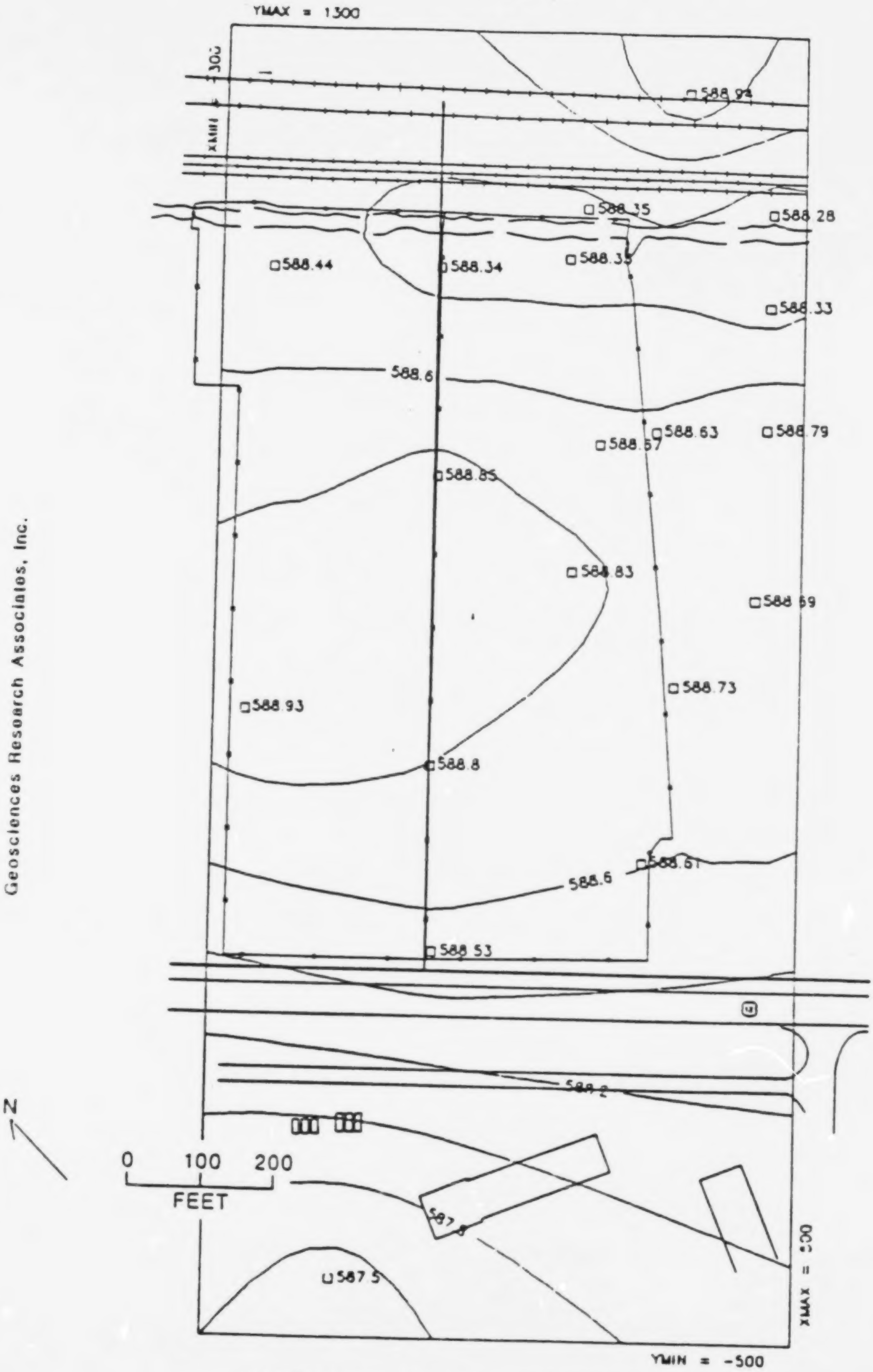
Surface drainage from a small portion (less than 1/2 acre) of the northeast end of the site flows directly into the ditch that is northeast of the site. Over the rest of the site, slopes are 0-2 percent, and there are no other drainage channels. Instead, the water temporarily ponds in the center of the site where it eventually evaporates or recharges the ground water. Surface drainage from the adjacent scrap yard and Industrial Highway also flow into these temporary ponds on Midco II.

The water level in the ditch is intimately connected to the level in the surficial aquifer. The ditch acts as a ground water sink, and ground water recharge from Midco II contributes a substantial amount to its flow.

-2-a

Figure 2

Geosciences Research Associates, Inc.


YMAX = 1300
XMIN = -300
588.94
588.35
588.28
588.44
588.34
588.35
588.33
588.6
588.63
588.79
588.57
588.85
588.83
588.69
588.73
588.93
588.8
588.61
588.6
588.53
588.2
N
0
100
200
FEET
587.8
587.5
XMAX = 500
YMIN = -500

AVERAGE HEAD CONTOUR MAP

AVERAGE HEAD (FEET MSL)

FIGURE 4-8

The ditch flows to the southeast into the Grand Calumet River, which is 1-1/4 mile southeast of the site. The gradient in the ditch is very low and the surface drainage area is minimal. Run-off is low and flow in the ditch is probably largely ground water recharge. In addition, vegetation in the ditch slows the flow rate. These conditions suggest minimal flow velocities and greatly reduced sediment transport.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

Waste operations, including drum storage, were initiated at Midco II during the summer of 1976 by the same operator as at Midco I. In January 1977, (following a major fire at Midco I) Midwest Industrial Waste Disposal Company was incorporated ostensibly for operating the Midco II site, and the operations at Midco I were transferred to Midco II. Operations included temporary bulk liquid and drum storage of waste and reclaimable materials, neutralization of acids and caustics, and on-site disposal via dumping into on-site pits, which allowed percolation into the ground water. One of these pits, called the filter pit, had an overflow pipe leading into the ditch (Figure 3).

By April 1977, approximately 12,000 to 15,000 55-gallon drums of waste materials were stored on site. In addition, approximately 10 above and below ground tanks were accumulated and used to hold wastes. The drums were stacked three high, and along with the tanks, were badly deteriorated and leaking. The wastes included oils, oil sludges, chlorinated solvents, paint solvents, paint sludges, acids, and spent cyanides. Also present were waste saturated soils caused by leaking drums and spillage, an open dump consisting mainly of drums, tires, and various wood wastes, and an excavated pit containing unidentified sludges.

In May 1977, the Stream Pollution Control Board charged Midco II with improper storage of cyanide waste, operation of an open dump, failure to obtain a construction or operation permit, and an improper discharge of solvents, paint sludges, acids, and spent cyanides.

On August 15, 1977, a fire at Midco II destroyed equipment, buildings, and an estimated 50,000 to 60,000 drums, including drums of cyanide stored in a building. A substantial number of drums containing chemical wastes survived the fire, although most were in a very deteriorated condition. This included 75-100 drums of cyanide.

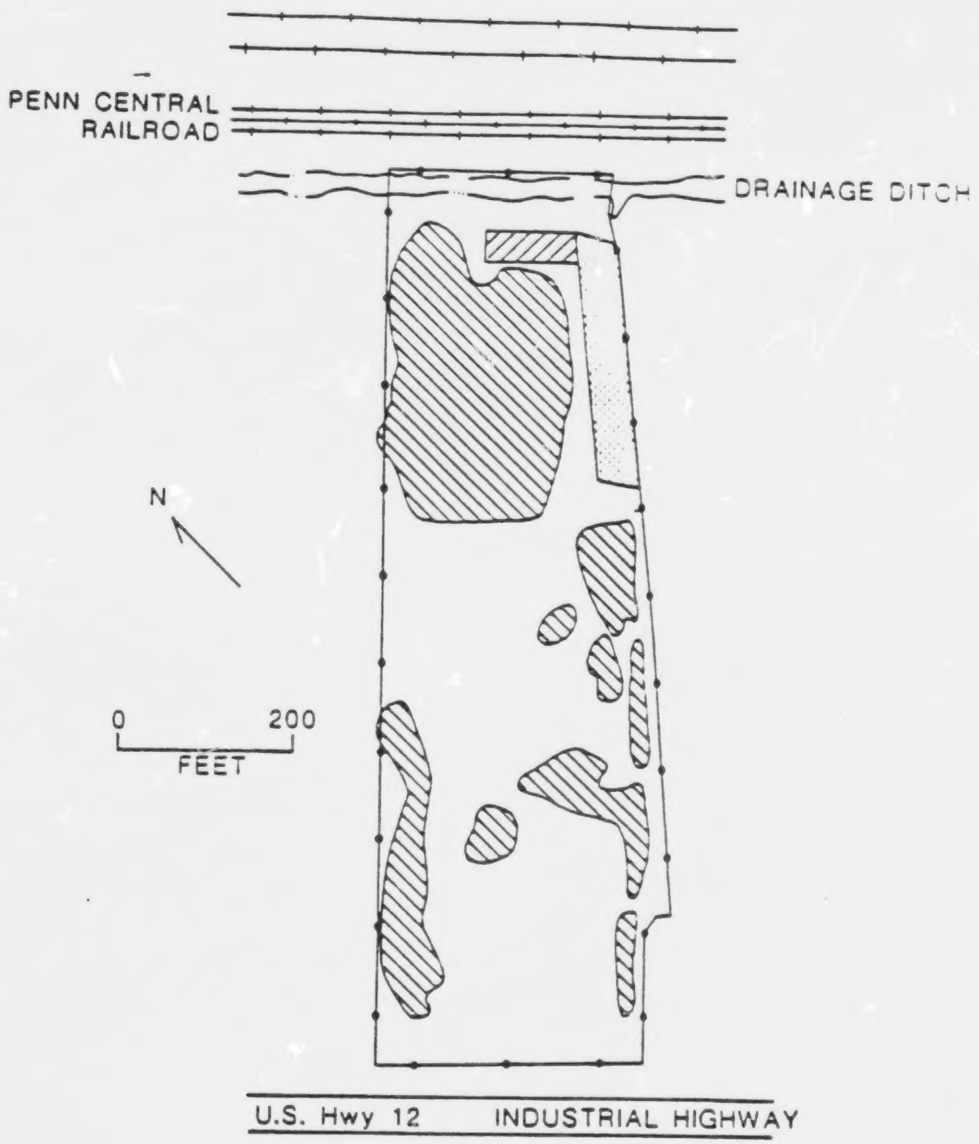
On February 24, 1978, the Lake County Circuit Court ordered Midwest Solvent Disposal Company to remove and properly dispose of drums of cyanide and other industrial wastes from Midco I and Midco II within 90 days. This order was never obeyed.

In August 1979, the U.S. EPA sampled a paint tank, eight barrels, the drainage ditch, drainage ditch sediment, and residue along the ditch. Based on these results, the United States filed a complaint in the Federal District Court in Hammond, Indiana under Section 7003 of the Resource Conservation and Recovery Act (RCRA) (Civil Action No. H-79-556). A Preliminary Injunction and Temporary Restraining Order was granted on

-3-a

Figure 3

Reprinted from "Remedial Investigation of Midwest Waste Disposal Company, Inc. (Midco II), Gary, Indiana" by Environmental Resources Management-North Central


PENN CENTRAL RAILROAD
DRAINAGE DITCH
N
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200
FEET
U.S. Hwy 12
INDUSTRIAL HIGHWAY

—•— CONTAINMENT FENCE

▨ FORMER DISPOSAL PIT (APPROXIMATE LOCATION)

☐ FORMER FILTER BED (APPROXIMATE LOCATION)

▧ FORMER DRUM STORAGE AREA (APPROXIMATE LOCATION)

FIGURE 1-3

MIDCO II

SITE MAP

FROM: EPA, On-Scene Coordinator's Report, 1984

January 31, 1980 that directed a Midco II property owner to report on efforts to remove surface wastes from Midco II. On December 4, 1980, the operators of Midwest Solvent Disposal Company were ordered to submit to U.S. EPA, a plan for the removal of all wastes stored on Midco II, and to design a plan to determine the nature and extent of soil and ground water contamination.

However, these court actions were ineffective, and in February 1981, the U.S. EPA conducted an investigation to evaluate the possible presence of an acute hazard to human health or the environment which could be remedied by short-term safeguards. In response to site conditions, the U.S. EPA funded the installation of a 10-foot high fence around the site. The fence was completed in August 1981.

The U.S. EPA funded a hydrogeologic study of the site during 1981 to 1983, in order to identify contaminants present in the soil and ground water, determine the ground water flow characteristics, and ascertain the extent of contamination attributable to site operations.

On January 19, 1984, the United States filed its First Amended Complaint for Civil Action No. H-79-556, adding claims for injunctive relief under Section 106 of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and for recovery of response costs incurred by the United States under Section 107 of CERCLA, and adding generator defendants.

From February to March 1984, the U.S. EPA conducted emergency removal activities, including the repair and extension of the site fence and the removal of 413 drums of waste. From January - March 1985, U.S. EPA removed the remaining drums (except for 5 drums containing PCB contaminated soils), tanks and debris from the surface of the site.

At the end of July 1985, the U.S. EPA began emergency removal of the sludge pit and filter bed contents (Figure 3). These materials were highly contaminated with PCBs and cyanide. The materials were excavated and placed in separate piles on site. The sludge pit was backfilled with crushed stone and the filter bed was backfilled with crushed stone and debris from the site, such as old tires, tire rims and construction waste. In December 1985, and January 1986, the PCB contaminated soil pile was removed and disposed of in an off-site hazardous waste landfill, and most of the cyanide contaminated pile was removed.

Midco II was placed on the National Priorities List (NPL) in October 1984. The NPL is a list of abandoned or uncontrolled hazardous waste sites that are eligible for investigation and remediation under CERCLA.

The U.S. EPA completed a Work Plan for a Remedial Investigation/ Feasibility Study (RI/FS) for this site in February 1985. The purpose of the RI was to collect data needed to determine the full extent of hazards remaining at the site and to evaluate alternatives for remedial actions. The RI Workplan included geophysical, soil gas, soil, hydrogeological, surface water, surface sediment and ground water investigations. However, the U.S. EPA discontinued its work on the RI/FS in April 1985 when a group of defendants agreed to conduct the RI/FS in accordance with the U.S. EPA-approved Work Plan.

An agreement was formalized on June 19, 1985, by a Partial Consent Decree in United States of America v. Midwest Solvent Recovery, Inc. et. al. lodged with the United States District Court for the Northern District of Indiana. This Partial Consent Decree required reimbursement of past costs and specified that an RI/FS be completed in accordance with the U.S. EPA's Work Plan for the Midco II site by the Defendants. Litigation was stayed until completion of the RI/FS.

The contractor for the defendants started work in May 1985. After review of the first draft Remedial Investigation (RI) report, U.S. EPA required additional sampling in February 1987. The sampling was completed and a final RI report was approved by U.S. EPA in March 1988. The contractor submitted the final FS report in February 1989.

III. COMMUNITY RELATIONS

A public meeting was held on July 18, 1985, to explain the proposed Remedial Investigation/Feasibility Study. U.S. EPA updated the community on the status of the RI/FS using fact sheets in November 1987 and December 1988.

A Proposed Plan was prepared explaining alternatives evaluated and the basis for preference for one alternative. The Plan was mailed to over 100 persons in the community. Availability of the Plan was published in two local newpapers. A public meeting was held on April 27, 1989 in a high school near the site.

Verbal public comments were received at the public meeting. Written comments were received from a resident of Gary, the City of Hammond, the Indiana Department of Highways, and the Midco Steering Committee, which represents potentially responsible parties at the site. A summary of the major comments, as well as U.S. EPA's response to them, is included in the Responsiveness Summary in the Appendix.

The U.S. EPA-selected remedial actions identified in the Record of Decision differ from the preferred alternative described in the Proposed Plan in the following ways:

1. As an alternative to deep well injection, the option of reinjection of the ground water back into the Calumet aquifer is allowed following treatment, with the condition that this operation not cause spreading of the salt plume.

2. A Treatability Variance is approved for the solidification/stabilization (S/S) operation from the Land Disposal Restriction (LDR) Treatment standards. This is being approved because existing available data do not demonstrate that S/S can attain LDR treatment standards consistently for all soil and debris at this

site. The Treatability Variance allows attainment of standards that have been demonstrated to be attainable for soil and debris.

IV. SCOPE AND ROLE OF RESPONSE ACTION

Removal of the surface wastes as well as excavation and removal of contaminated soil and waste materials from the sludge pit and filter bed have been completed by U.S. EPA, (except for approximately 100 cubic yards of contaminated soil from the filter bed which will remain on-site and be addressed during the final remedial action). This is the final remedial action and will address the remaining contamination at the site including contaminated subsurface soil and materials, contaminated ground water and contaminated sediments in the adjacent ditch.

V. SITE CHARACTERISTICS

The RI showed that on-site subsurface soils are highly contaminated by a large number of chemicals. Ground water below the site is also highly contaminated, but the contaminated ground water does not extend very far from the site. Some surface sediments in the ditch north of the site were also highly contaminated. The ground water was also highly saline, especially the lower part of the aquifer. The high salinity is theorized to be largely due to leaching from fill on the Midco II site as well as on adjacent properties. This filling occurred prior to the Midco operations.

Source:

On-site subsurface soils are a continuing source of contaminants to the ground water and surface water. Fifteen test trenches were excavated into the most contaminated portions of the site and thirty samples were collected to characterize the extent and nature of this source. Several individual sources of contamination appear to exist in the northeastern, central-northeastern and southeastern portions of the site. The minimum, maximum and mean concentrations of chemicals detected in these samples are summarized in Table 1 in the Appendix. Elevated concentrations of the following compounds (compared to background) were detected:

aluminum
arsenic
baruim
cadmium
chromium
copper
lead
nickel
zinc
1,4 dichlorophenol
isophorone
2,4-dimethylphenol

methylene chloride
acetone
2-butanone
chloroform
1,1,1-trichloroethane
1,2-dichloropropane
trichloroethene
1,1,2-trichloroethane
benzene
4-methyl-2-pentanone
tetrachloroethene
toluene
ethylbenzene
total xylenes
phenol

Various polyaromatic hydrocarbons and phthalates were detected in the low mg/kg range. PCBs were detected in several samples at levels below 50 mg/kg.

Total volatile organic compounds were as high as 0.38% by weight and consisted predominantly of ethylbenzene, toluene and xylene. Total semi-volatile organic compounds were as high as 402 mg/kg and consisted predominately of polyaromatic hydrocarbons, phthalates, alkanes, and iron tricarbonyl (n-phenyl-2-pyridinyldmethylene) benzamine N,N_1. Arsenic was as high as 1,430 mg/kg, chromium as high as 1,960 mg/kg, copper as high as 4,640 mg/kg, lead as high as 2,810 mg/kg, zinc as high as 4650 mg/kg, cadmium as high as 11 mg/kg and nickel as high as 1430 mg/kg. The concentrations of a number of inorganics in the on-site soils appear to be correlated to the concentration of aluminum, including arsenic, cadmium, lead, barium, chromium, copper, nickel, antimony and tin.

Surface water samples were collected at five locations in the ditch during two rounds of sampling. An additional sample was collected further upstream on a later date. The maximum, minimum and average concentrations are summarized in Table 1. Methylene chloride, 1,2-dichloroethane, acetone, trans-1,2-dichlorethene and cyanide were detected during both rounds of sampling in locations adjacent to the site. The compounds 1,1,1-trichlorethane, 4-methyl-2-pentonone, toluene, xylenes, benzidene, n-nitrosodiphenylamine and some phthalate compounds were detected in one of the rounds of sampling. Some metals were also detected at what appear to be elevated concentrations.

Surface Sediments:

Surface sediment samples were collected from the ditch in five locations during two rounds of sampling and in three additional locations during the first round. A third round of sampling included two additional sampling locations farther upstream. The results show a large increase in concentration of a number of hazardous substances adjacent to and for a short distance downstream from the site. The concentrations drop off quickly downstream from the site. These hazardous substances include: methylene chloride; acetone, ethylbenzene, toluene, benzene, 2-butanone, arsenic, n-nitrosodiphenyl amine, chlordane, phthalate compounds, PCBS, polyaromatic hydrocarbons, cyanide, chromium, and lead. The maximum, minimum and average concentrations are summarized in Table 1. The results for total volatile organic compounds are shown in Figure 4, and for total semi-volatile organic compounds in Figure 5.

Ground Water:

Thirty-three monitoring wells were installed and sampled during two rounds of sampling. Eight wells were installed and sampled in an additional round of sampling. The maximum, minimum and average concentrations of all the ground water samples are summarized in Table 1.

An unanticipated result was that the aquifer in the vicinity of Midco II is highly contaminated with salt consisting primarily of potasium, sodium and chloride. The basal part of the aquifer contains as high as 60,000 mg/l of chloride. The extent of this contamination is indicated by the chloride isolines for the shallow wells in Figure 6 and the deep wells in Figure 7. The shallow wells are relatively low in salt content compared to the deeper wells. If the source was the fill, this suggests that the salinity of the fill is largely leached out. It is probable that bulk chemical disposal in the filter bed also contributes to the high salinity in ground water at the site.

Some ground water sampling results for hazardous substances are summarized in Figures 8, 9, and 10. Cyanide was detected in the on-site ground water in all but three wells. The highest cyanide value (7,830 ug/l) was detected during Phase I at E10, located adjacent to the former filter bed. The highest cyanide concentration in off-site wells were detected at cluster F located very close to the former filter bed (Figure 8).

VOCs were detected in all but two on-site monitoring clusters and in most off-site wells (Figure 9). In general, deep wells had lower concentrations of halogenated volatile hydrocarbons than shallower wells. Ketones were detected in most on-site wells, as well as a number of off-site monitoring wells. On site, the highest concentrations of toluene, ethylbenzene, and total xylene were detected at E10, located close to the former filter bed location, and the highest concentration of benzene on site was detected at B10. Off site, volatile aromatic hydrocarbons were detected only at F10, F30, C10, MW8, and L30. Benzene was detected at C10, MW8, and L30.

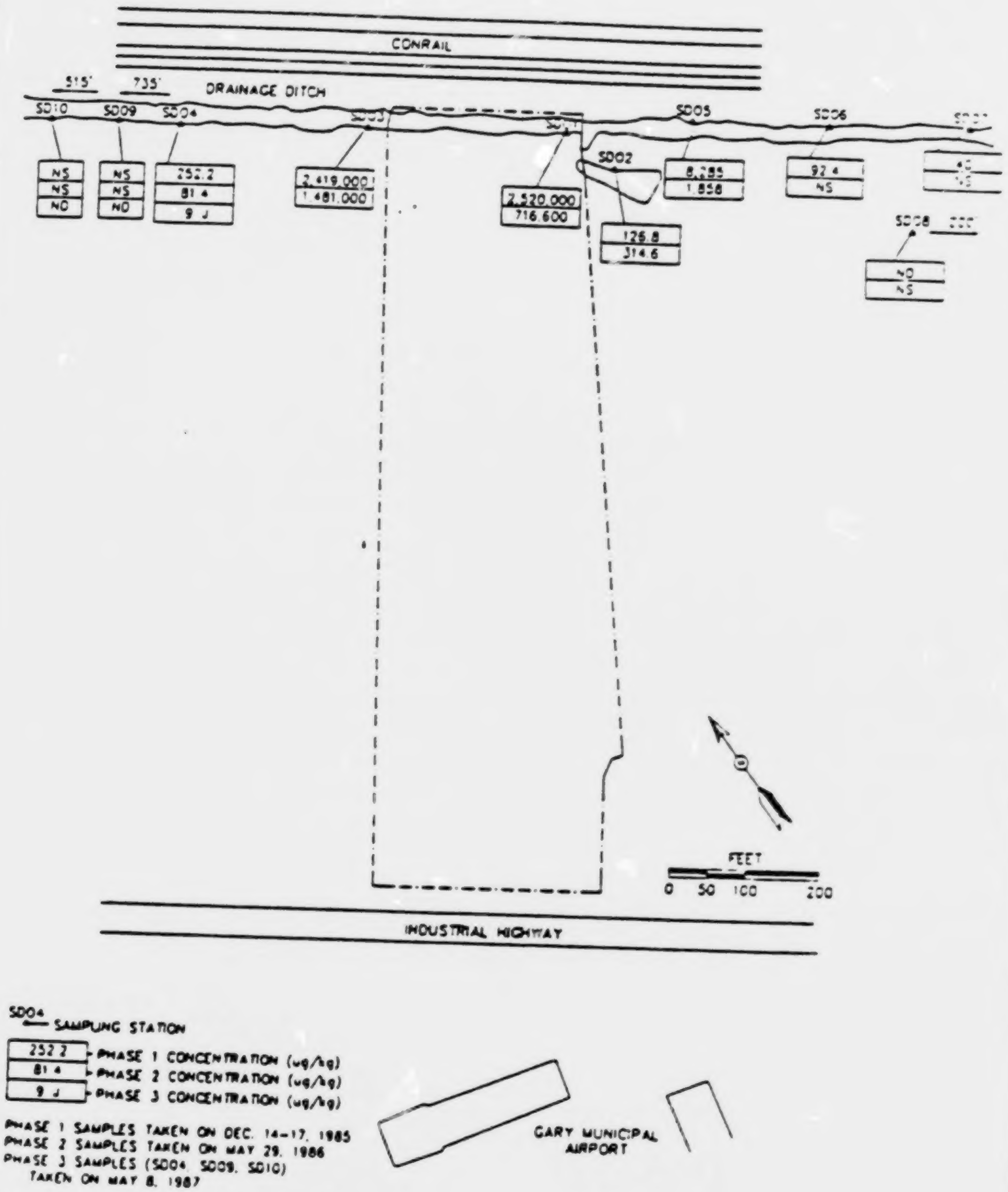
Figure 10 shows the total semivolatile concentrations in the ground water. Similar to the total VOC results, the highest concentrations of total semivolatiles were detected at E10. PAHs were detected in shallow on-site wells at concentrations of less than 210 ug/l. The only PAH detected in deeper on-site wells was 2-methylnaphthalene. PAHs were also detected in some off-site wells. The concentrations of PAHs at the off-site, upgradient well MW8 were higher than detected in the on-site wells, indicating an off-site source of these compounds. Phthalates were detected on and off site. No evidence of PCB release to the ground water within the site boundaries was found during the RI at the analytical detection limits used. However, PCBs detected at C10 may have been a result of Midco II operations.

Biota:

The U.S. Fish and Wildlife Service collected samples of crayfish, snapping turtles, small mammals and earthworms near Midco II. These samples were analyzed for organic and inorganic hazardous substances. The results were compared to the results in control samples. Although the U.S. Fish and Wildlife Service has not yet issued its final report, preliminary results

8-a

Figure 4


CONRAIL
515'
735'
DRAINAGE DITCH
SD10
SD09
SD04
SD03
SD01
SD05
SD06
SD07
SD02
SD08
200'
NS
NS
ND
NS
NS
ND
252.2
81.4
9 J
2,419,000
1,481,000
2,520,000
716,600
126.8
314.6
8,285
1,858
92.4
NS
ND
NS
ND
NS
FEET
0
50
100
200
INDUSTRIAL HIGHWAY
GARY MUNICIPAL AIRPORT

SD04 ← SAMPLING STATION

252.2 – PHASE 1 CONCENTRATION (ug/kg)
81.4 – PHASE 2 CONCENTRATION (ug/kg)
9 J – PHASE 3 CONCENTRATION (ug/kg)

PHASE 1 SAMPLES TAKEN ON DEC. 14–17, 1985
PHASE 2 SAMPLES TAKEN ON MAY 29, 1986
PHASE 3 SAMPLES (SD04, SD09, SD10) TAKEN ON MAY 8, 1987

STATION SD08 IS LOCATED IN THE DRAINAGE DITCH, 200 FT SOUTHEAST OF SD07

STATION SD10 IS LOCATED IN A PONDED AREA IN THE DIRECTION SHOWN

NS NOT SAMPLED
ND NOT DETECTED
J ESTIMATED VALUE

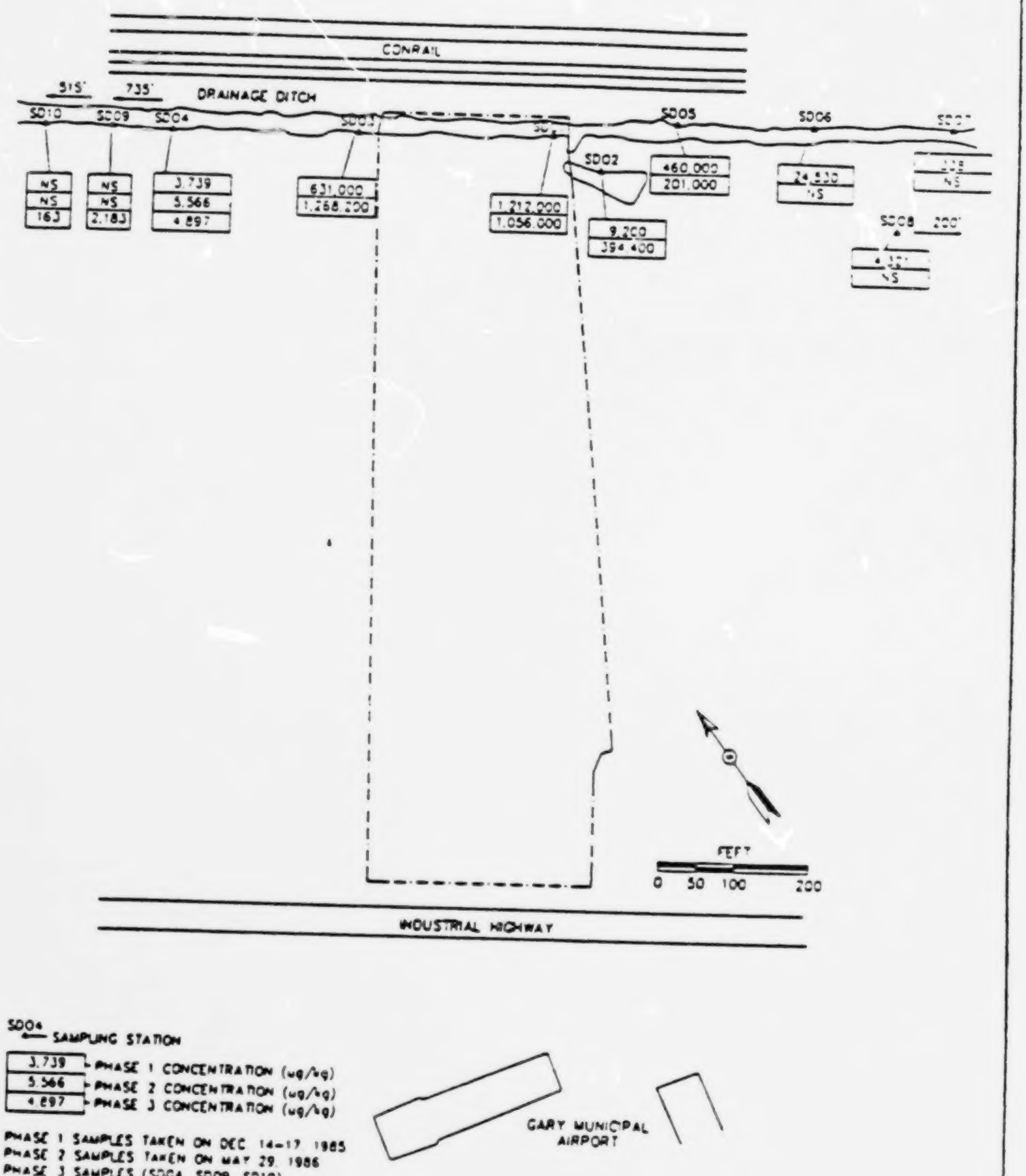
FIGURE 1-19
MIDCO II
SEDIMENT SAMPLED
TOTAL VOLATILES
PHASES 1, 2 AND 3

Reprinted from "Remedial Investigation of Midwest Waste Disposal Company, Inc. (Midco II), Gary, Indiana"
by Environmental Resources Management-North Central

-2-b

Figure 5

Reprinted from "Remedial Investigation of Midwest Waste Disposal Company, Inc. (Midco II), Gary, Indiana" by Environmental Resources Management-North Central


CONRAIL
515'
735'
DRAINAGE DITCH
SD10
SD09
SD04
SD03
SD01
SD02
SD05
SD06
SD07
SD08
200'
NS
NS
163
NS
NS
2,183
3,739
5,566
4,897
631,000
1,268,200
1,212,000
1,056,000
9,200
394,400
460,000
201,000
24,530
NS
NS
NS
FEET
0 50 100 200
INDUSTRIAL HIGHWAY
SD04
SAMPLING STATION
3,739 PHASE 1 CONCENTRATION (ug/kg)
5,566 PHASE 2 CONCENTRATION (ug/kg)
4,897 PHASE 3 CONCENTRATION (ug/kg)
GARY MUNICIPAL AIRPORT

PHASE 1 SAMPLES TAKEN ON DEC. 14-17, 1985
PHASE 2 SAMPLES TAKEN ON MAY 29, 1986
PHASE 3 SAMPLES (SD04, SD09, SD10)
TAKEN ON MAY 8, 1987

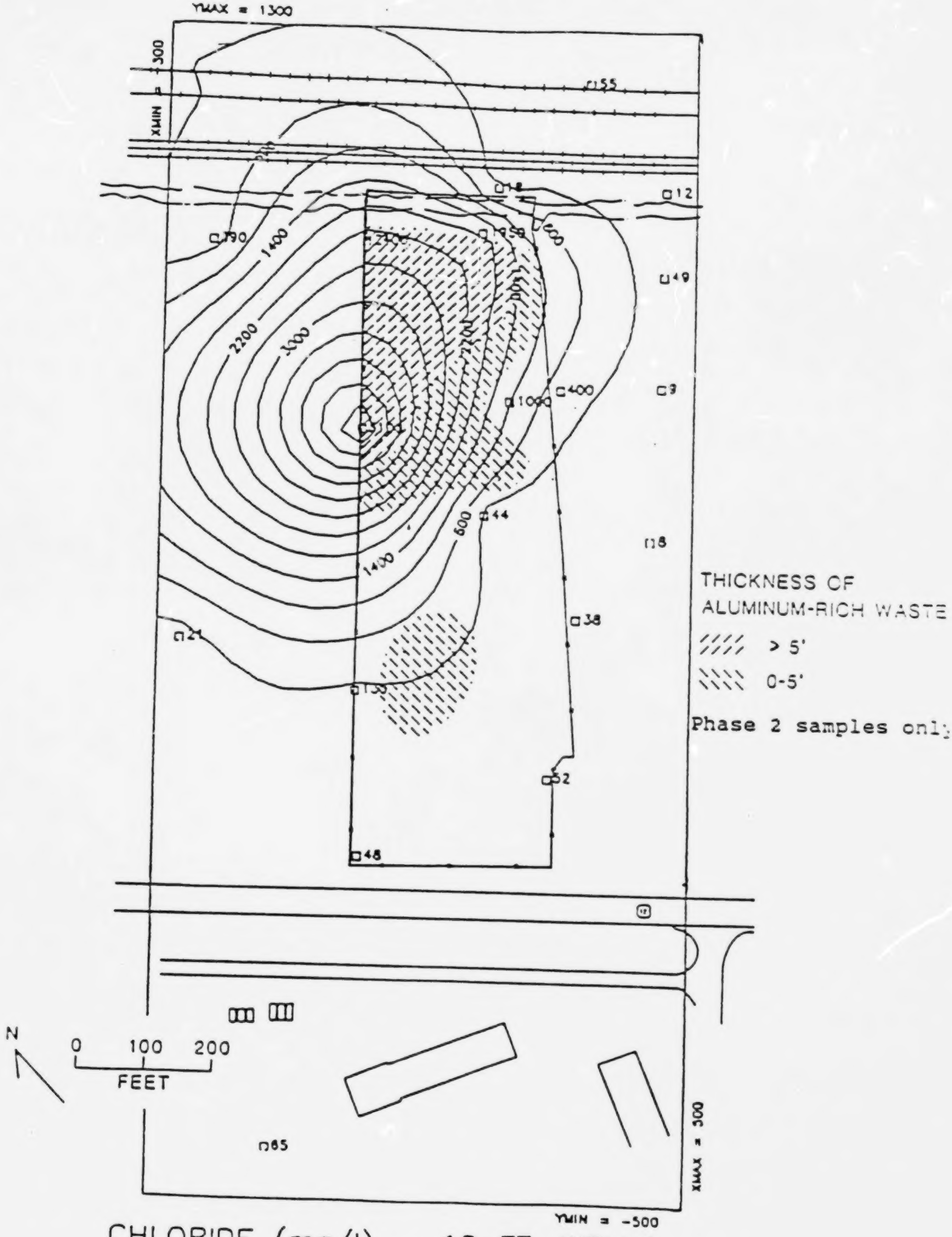
STATION SD08 IS LOCATED IN THE DRAINAGE DITCH, 200 FT SOUTHEAST OF SD07

STATION SD10 IS LOCATED IN A PONDED AREA IN THE DIRECTION SHOWN

NS NOT SAMPLED

FIGURE 1-20
MIDCO II
SEDIMENT SAMPLES
TOTAL SEMIVOLATILES
PHASES 1, 2 AND 3

-8-C


YMAX = 1300
XMIN = 300
155
18
12
190
1400
2200
3000
959
600
1400
1000
400
49
3
44
600
1400
8
38
21
130
52
48
THICKNESS OF ALUMINUM-RICH WASTE
> 5'
0-5'
Phase 2 samples only
N
0
100
200
FEET
65
XMAX = 300
YMIN = -500

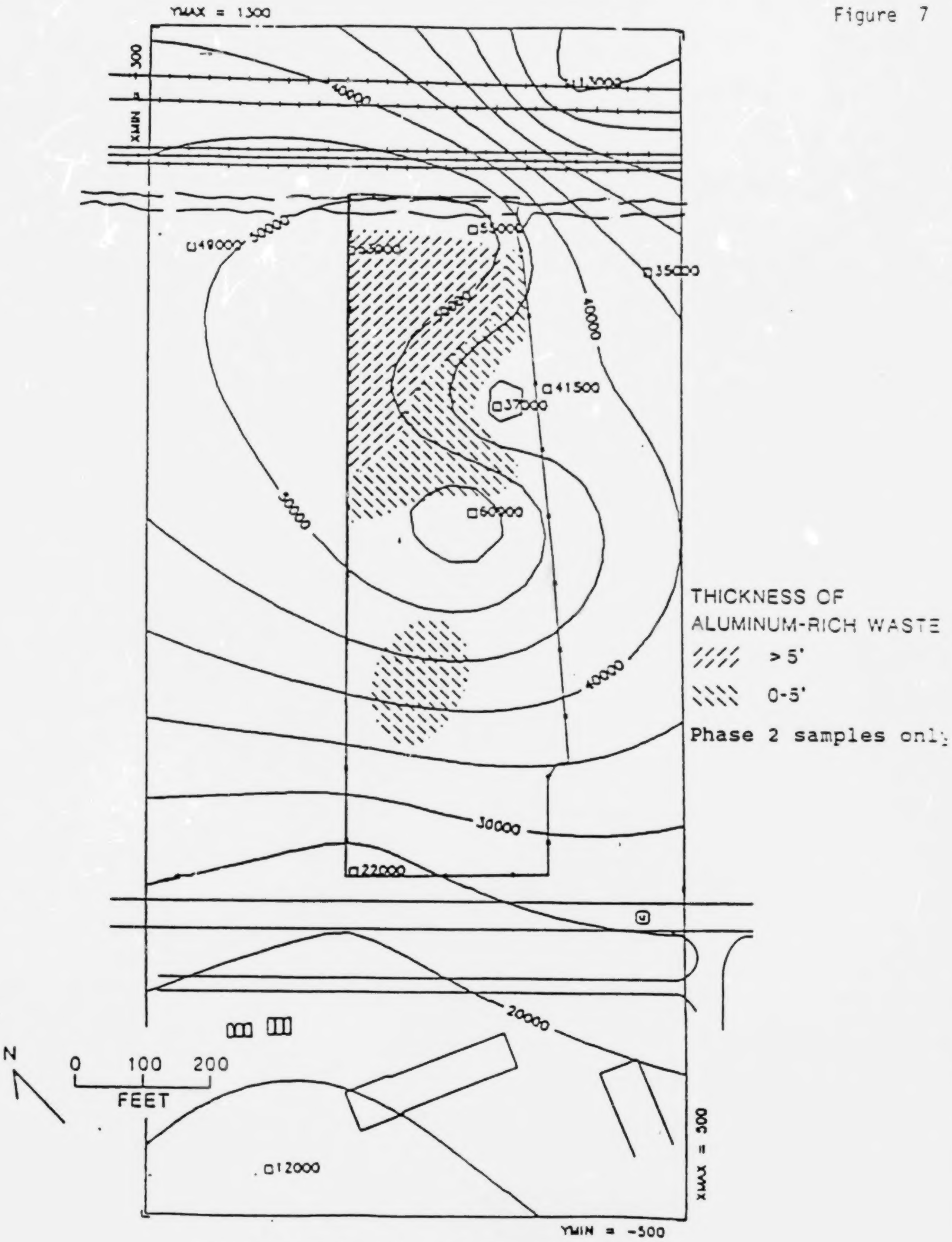
CHLORIDE (mg/l) – 10 FT. WELLS

Figure 5-25

-8-d

Figure 7

Geosciences Research Associates, Inc.


YMAX = 1300
XMIN = 300
113000
40000
30000
□49000
□53000
□55000
□35000
50000
40000
□41500
□37000
30000
□60900
40000
30000
□22000
20000
□12000
XMAX = 500
YMIN = -500
N
0 100 200
FEET
THICKNESS OF ALUMINUM-RICH WASTE
//// > 5'
\\\\ 0-5'
Phase 2 samples only

CHLORIDE (mg/l) - 50 FT. WELLS

Figure 5-26

-8-e

Figure 8

Reprinted from "Remedial Investigation of Midwest Waste Disposal Company, Inc. (Midco II), Gary, Indiana" by Environmental Resources Management-North Central

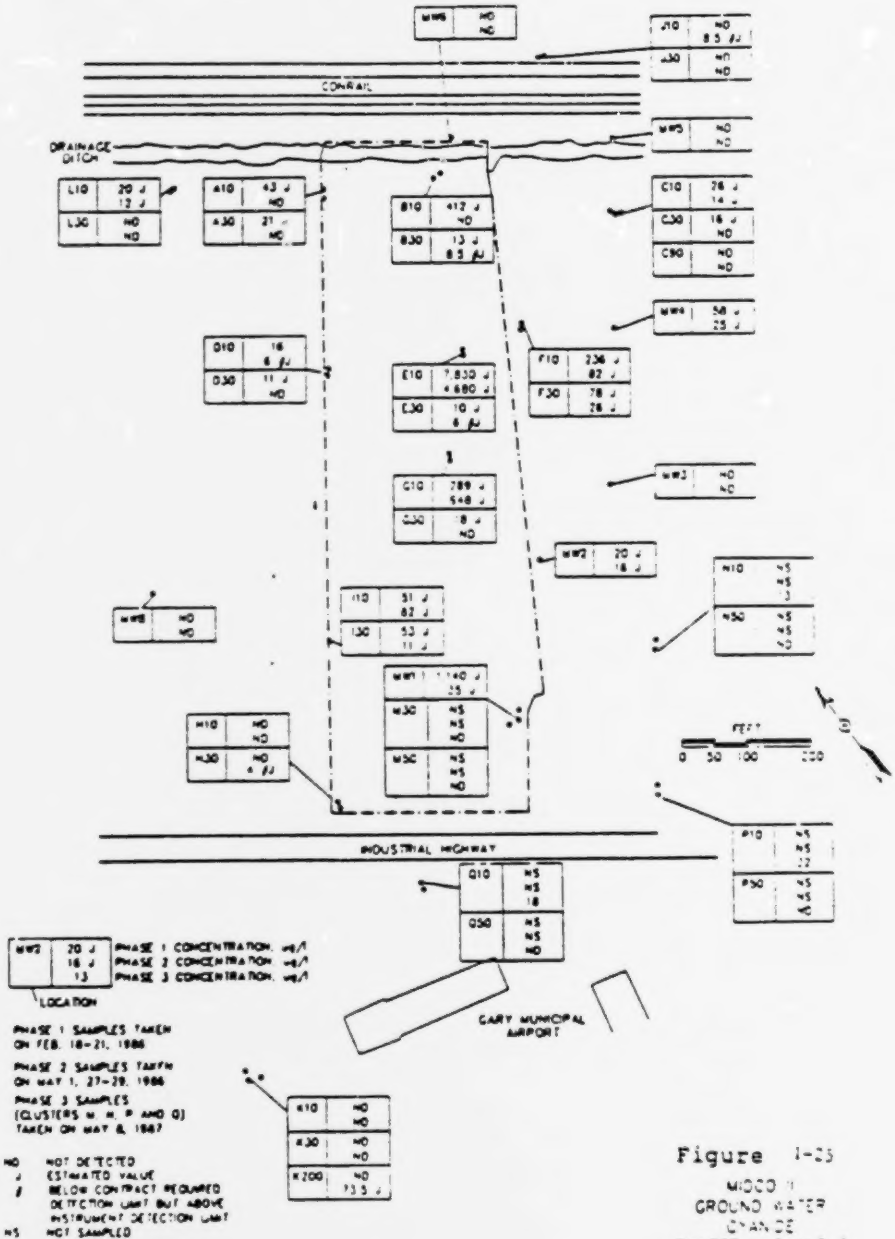

MW6 ND ND
J10 ND 8.5 /J
J30 ND ND
CONRAIL
MW5 ND ND
DRAINAGE DITCH
L10 20 J 12 J
L30 ND ND
A10 43 J ND
A30 21 J ND
B10 412 J ND
B30 13 J 8.5 /J
C10 26 J 14 J
C30 16 J ND
C90 ND ND
MW4 58 J 25 J
D10 16 6 /J
D30 11 J ND
E10 7,830 J 4,680 J
E30 10 J 6 /J
F10 236 J 82 J
F30 78 J 26 J
G10 789 J 548 J
G30 18 J ND
MW3 ND ND
MW2 20 J 16 J
N10 NS NS 13
N50 NS NS ND
MW8 ND ND
I10 51 J 82 J
I30 53 J 11 J
MW1 1,140 J 25 J
M30 NS NS ND
M50 NS NS ND
H10 ND ND
H30 ND 4 /J
FEET
0 50 100 200
INDUSTRIAL HIGHWAY
P10 NS NS 22
P50 NS NS ND
Q10 NS NS 18
Q50 NS NS ND
GARY MUNICIPAL AIRPORT
K10 ND ND
K30 ND ND
K200 ND 73.5 J
MW2 20 J 16 J 13
PHASE 1 CONCENTRATION, ug/l
PHASE 2 CONCENTRATION, ug/l
PHASE 3 CONCENTRATION, ug/l
LOCATION
PHASE 1 SAMPLES TAKEN ON FEB. 18-21, 1986
PHASE 2 SAMPLES TAKEN ON MAY 1, 27-29, 1986
PHASE 3 SAMPLES (CLUSTERS M, N, P AND Q) TAKEN ON MAY 8, 1987
ND NOT DETECTED
J ESTIMATED VALUE
/ BELOW CONTRACT REQUIRED DETECTION LIMIT BUT ABOVE INSTRUMENT DETECTION LIMIT
NS NOT SAMPLED

Figure 1-35

MIDCO II
GROUND WATER
CYANIDE
PHASES 1, 2 AND 3

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8-7

Figure 9

Reprinted from "Remedial Investigation of Midwest Waste Disposal Company, Inc. (Midco II), Gary, Indiana"
by Environmental Resources Management-North Central

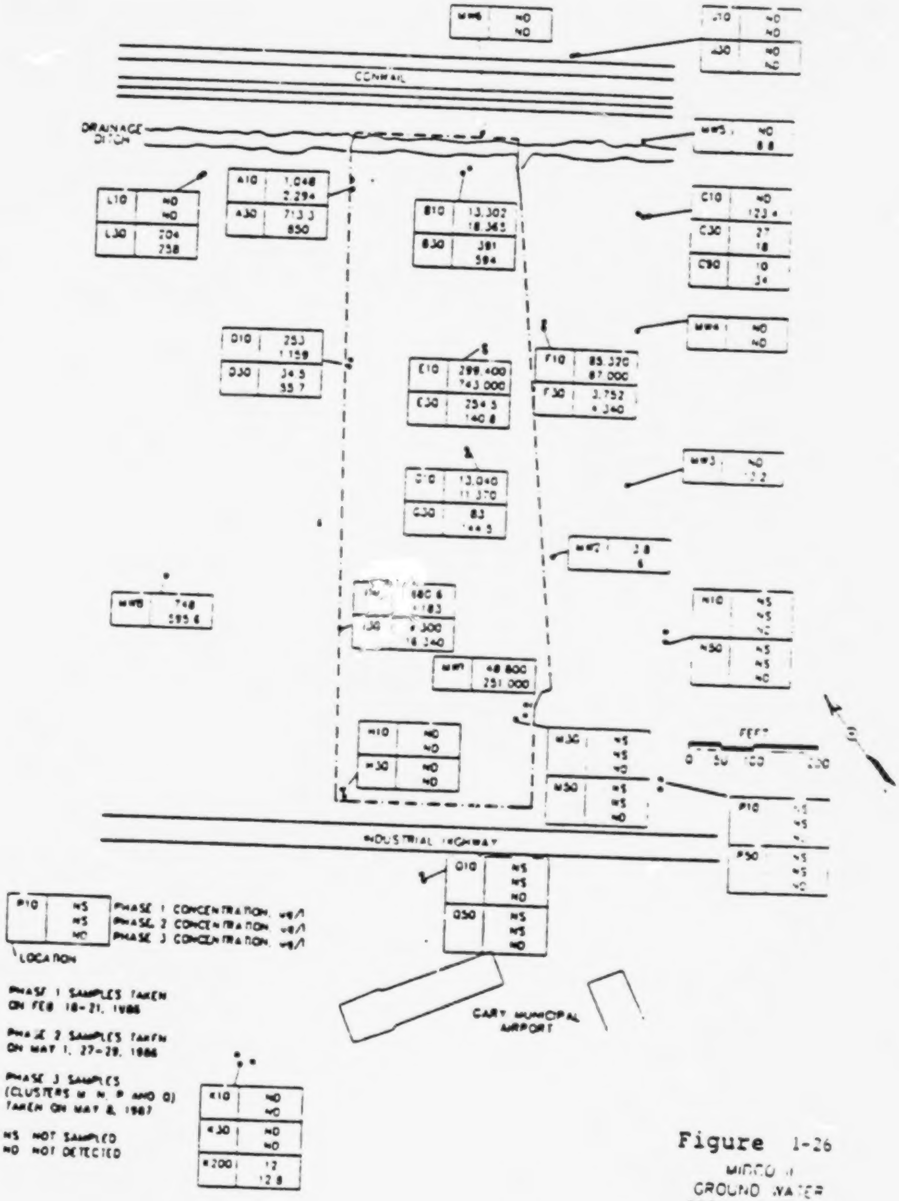
MW6 ND ND
J10 ND ND
J30 ND ND
CONRAIL
DRAINAGE DITCH
MW5 ND 8.8
L10 ND ND
L30 204 258
A10 1,048 2,294
A30 713.3 850
B10 13,302 18,365
B30 381 584
C10 ND 123.4
C30 27 18
C90 10 34
D10 253 1,159
D30 34.5 55.7
MW4 ND ND
E10 299,400 743,000
E30 254.5 140.8
F10 85,320 87,000
F30 3,752 4,340
MW3 ND 13.2
G10 13,040 11,370
G30 83 144.5
MW2 3.8 6
MW8 748 595.6
I10 880.6 1,183
I30 4,300 16,340
N10 NS NS ND
N50 NS NS ND
MW1 48,800 251,000
H10 ND ND
H30 ND ND
M30 NS NS ND
M50 NS NS ND
FEET
0 50 100 200
P10 NS NS ND
P50 NS NS ND
INDUSTRIAL HIGHWAY
Q10 NS NS ND
Q50 NS NS ND
P10 NS NS ND
PHASE 1 CONCENTRATION, ug/l
PHASE 2 CONCENTRATION, ug/l
PHASE 3 CONCENTRATION, ug/l
LOCATION
PHASE 1 SAMPLES TAKEN ON FEB 18-21, 1986
PHASE 2 SAMPLES TAKEN ON MAY 1, 27-29, 1986
PHASE 3 SAMPLES (CLUSTERS M, N, P AND Q) TAKEN ON MAY 8, 1987
NS NOT SAMPLED
ND NOT DETECTED
K10 ND ND
K30 ND ND
K200 12 12.8
GARY MUNICIPAL AIRPORT

Figure 1-26
MIDCO II
GROUND WATER
TOTAL VOLATILES
PHASES 1, 2 AND 3

8-9

Figure 10

Reprinted from "Remedial Investigation of Midwest Waste Disposal Company, Inc. (Midco II), Gary, Indiana" by Environmental Resources Management-North Central

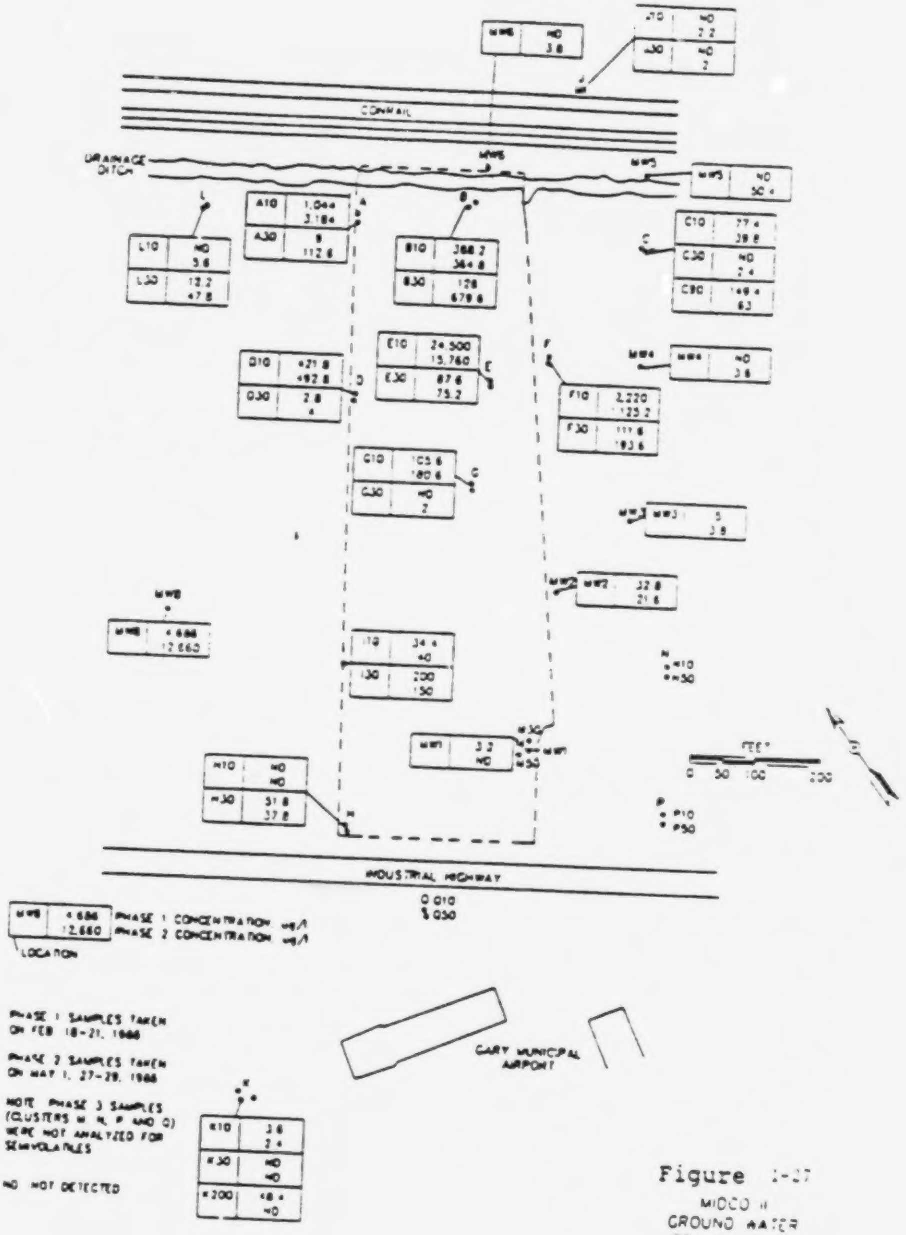
MW6 | ND 3.8
J10 | ND 2.2
J30 | ND 2
J
CONRAIL
DRAINAGE DITCH
MW6
MW5
MW5 | ND 50.4
L
L10 | ND 5.6
L30 | 12.2 47.8
A10 | 1,044 3,184
A30 | 9 112.6
A
B
B10 | 388.2 364.8
B30 | 128 679.6
C
C10 | 77.4 39.8
C30 | ND 2.4
C80 | 149.4 63
D10 | 421.8 492.8
D30 | 2.8 4
D
E10 | 24,500 15,760
E30 | 87.6 75.2
E
F
F10 | 2,220 125.2
F30 | 111.8 193.6
MW4
MW4 | ND 3.8
G10 | 105.6 180.6
G30 | ND 2
G
MW3
MW3 | 5 3.8
MW2
MW2 | 32.8 21.6
MW8
MW8 | 4,686 12,660
I10 | 34.4 40
I30 | 200 150
N
N10
N50
MW1 | 3.2 ND
M30
MW1
M50
FEET
0 50 100 200
H10 | ND ND
H30 | 51.8 37.8
H
P
P10
P50
INDUSTRIAL HIGHWAY
O O10
O O50
MW8 | 4,686 12,660
PHASE 1 CONCENTRATION ug/l
PHASE 2 CONCENTRATION ug/l
LOCATION
PHASE 1 SAMPLES TAKEN ON FEB 18-21, 1986
PHASE 2 SAMPLES TAKEN ON MAY 1, 27-29, 1986
NOTE PHASE 3 SAMPLES (CLUSTERS M, N, P AND O) WERE NOT ANALYZED FOR SEMIVOLATILES
ND NOT DETECTED
GARY MUNICIPAL AIRPORT
K
K10 | 3.6 2.4
K30 | ND ND
K200 | 48.4 ND

Figure 1-27

MIDCO II
GROUND WATER
SEMIVOLATILES
PHASES 1 AND 2

indicate that the following hazardous substances were frequently detected at elevated concentrations relative to the control samples: 2-butanone; benzene; toluene; ethylbenzene; aluminum; chromium; copper and lead. All of these constituents were detected at elevated concentrations in soils, ground water, surface waters or sediments in on-site and in directly affected areas.

SUMMARY OF SITE RISKS

For the future development scenario including usage of the ground water, soil ingestion, and air exposure, an estimate of the health risks is as follows:

	Lifetime Cumulative Carcinogenic Risk*	Cumulative Chronic Non-carcinogenic Risk Index*
Exposure to Ground Water	2.6×10^{-2}	124
Exposure to soils	3.3×10^{-4}	2.99

* From Table 4-21 of the Addendum to Public Comment Feasibility Study

The main compounds causing the carcinogenic risks are:

Ground water - trichloroethlene, methylene chloride, isophorone, 1,1-dichloroethane, arsenic

Soils - PCBs, trichloroethlene, tetrachloroethene, arsenic, benzo(a)-pyrene

The main compounds causing the chronic non-carcinogenic risks are:

Ground water - 4-methyl-2-pentanone; methylene chloride; selenium; arsenic; acetone; 2-butanone; and ethylbenzene.

Soils - ethylbenzene, xylenes, arsenic and tetrachloroethene.

The following hazardous substances were detected at concentrations exceeding the Primary Drinking Water Regulation, Maximum Contaminant Levels (MCLs) (40 CFR 141) in ground water near the site: benzene; 1,1-dichloroethene; 1,2-dichlorpropane; ethylbenzene; 1,1,1-trichloroethane; trichloroethene; trans-1,2-dichloroethene; toluene; vinyl chloride; xylenes; cadmium; chromium; lead; arsenic; silver; selenium; and barium.

A cumulative subchronic hazard index for an on-site future use scenario was calculated to be 27. This index is calculated by adding the ratios of the estimated subchronic exposure rate (SER) to the Acceptable Subchronic

Intake (ASI) for each chemical. The subchronic hazard index exceeded unity for toluene due to inhalation while bathing, to selenium and cyanide due to drinking water ingestion, and for copper due to ingestion of drinking water, and soil ingestion. If the subchronic hazard index is less than one or unity, no adverse health effects would be expected. (Remedial Investigation of Midwest Solvent Disposal Company (Midco II). March 1988. p.6-55 and Table 6-17).

The estimated lifetime, carcinogenic risks to the nearest resident is 5×10^{-6} due to play and recreational activities in the ditch resulting in exposure to arsenic, trichloroethene, methylene chloride, isophorone, and 1,1-dichloroethane that migrated from the site. (Remedial Investigation of Midwest Solvent Disposal Company) (Midco II). March 1988. Table 6-19).

If no action is taken to contain or recover the ground water, contaminants will continue to migrate from the site and are predicted to affect ground water in the area shown in Figure 11. Two water wells used for non-drinking purposes located on the Gary Airport property are in the path of the plume. No existing wells used for drinking purposes would be affected. The ground water would also continue to contaminate the ditch and cause the above-mentioned, human health risk to off-site residents as well as environmental effects.

It has been argued that the Calumet aquifer at Midco II should be considered a Class III aquifer because of the high salinity, and, therefore, the aquifer should not be protected for drinking water usage. However, because the salinity is not natural and has not affected a large portion of the aquifer and because the ground water in at least some portions of the aquifer is usable for drinking, U.S. EPA has determined that the Calumet aquifer in the vicinity of Midco II is a Class II aquifer and should be protected for drinking water usage.

It has also been argued that there should be considered no risk due to future drinking water usage because the high salinity would prevent its usage. However, there is no assurance that the hazardous substances will always migrate within the salinity plume. In fact Figures, 6 and 7 show that the shallow portion of the aquifer below the site (where the highest hazardous substance contaminant levels exist) has a total dissolved solids content of much less than 10,000 mg/l, the limit used in the Underground Injection Control Program as a cut-off point for drinking water usage. In addition, a large portion of the salinity is due to the Midco II site and possibly due to the Midco II operations.

Compounds detected in the drainage ditch and ponded area northeast of the site which are above freshwater chronic water quality criteria include cadmium, chromium, copper, iron, lead, mercury, nickel, silver, zinc, cyanide and di-n-butylphthalate. The U.S. Fish and Wildlife Service noted that there are no fish present in the ditch downstream from Midco II, apparently due to contamination from Midco II and other sources. The Service believes that biota that do live in the vicinity of Midco II have accumulated elevated concentrations of volatile and inorganic compounds which adversely affect fish and wildlife resources.

-10-a

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Figure II

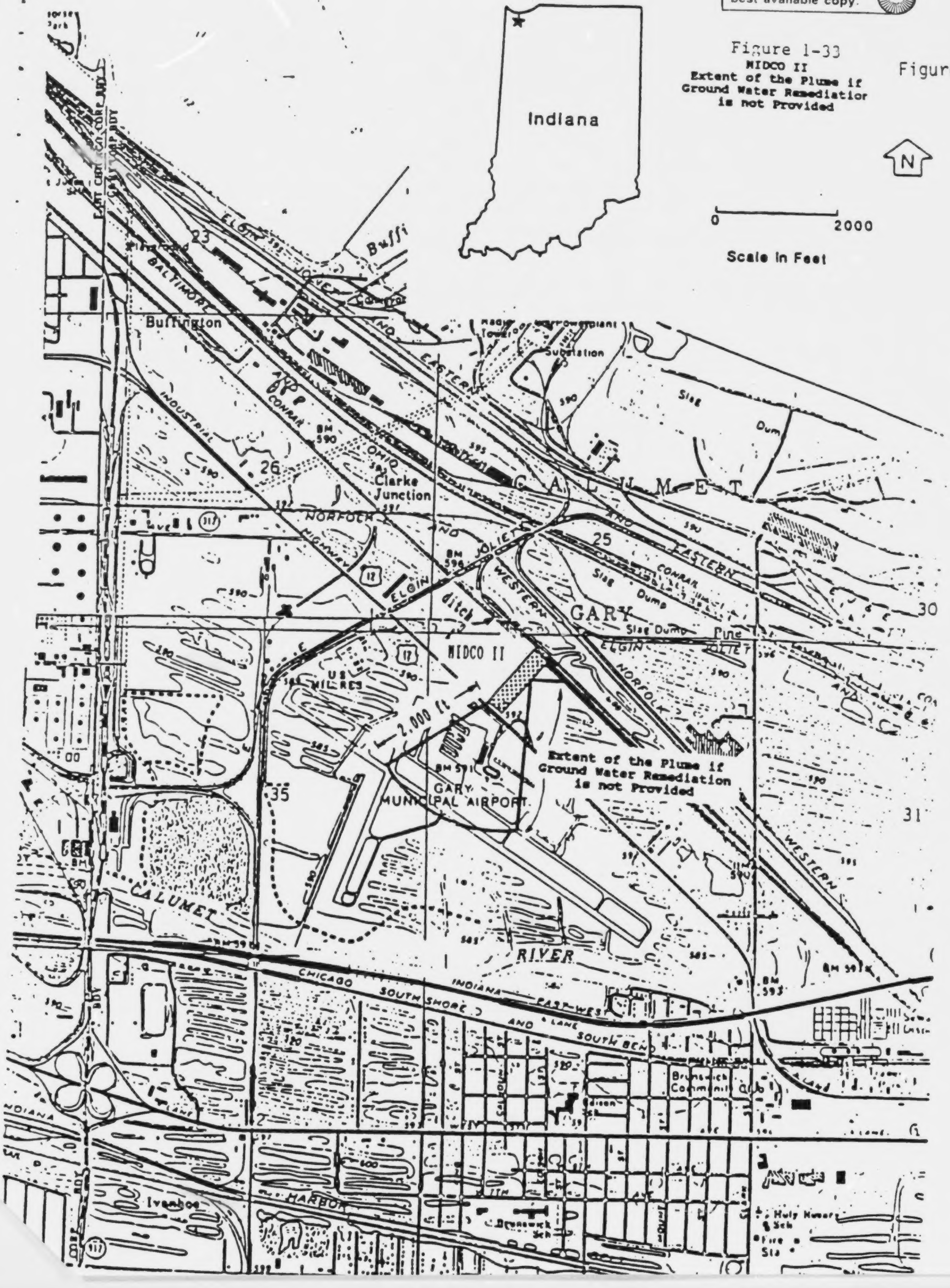


Figure 1-33
MIDCO II
Extent of the Plume if Ground Water Remediation is not Provided

Indiana
N
0
2000
Scale in Feet
Buffington
Clarke Junction
BALTIMORE AND OHIO
ELGIN JOLIET AND EASTERN
NORFOLK AND WESTERN
CONRAIL
INDUSTRIAL HIGHWAY
CALUMET
GARY
MIDCO II
2,000 ft
Extent of the Plume if Ground Water Remediation is not Provided
GARY MUNICIPAL AIRPORT
Slag Dump
Slag Dump
US MIL RES
ditch
CALUMET RIVER
CHICAGO SOUTH SHORE AND SOUTH BEND
INDIANA HARBOR
Brunswick Community Club
Edison Sch
Brunswick Sch
Holy Rosary Sch
Ivanhoe
23
25
26
30
31
35
12
117
590
595

Contaminant migration from Midco II through ground water and surface water pathways moves to Lake Michigan. Significant migratory bird and anadromous fish resources exist in Lake Michigan, and these could be impacted.

VIII. DESCRIPTION OF ALTERNATIVES

A large number of alternatives were screened, using engineering judgement for applicability, past performance and implementability to address the contaminated subsurface soil and fill materials, the contaminated ground water and contaminated surface sediments. Detailed evaluations were conducted for 14 alternatives, which are combinations of the most promising technologies. These technologies can be categorized as follows:

Containment:

- multilayered cap
- slurry wall

Ground Water Treatment:

- pumping of contaminated ground water and disposal in an underground injection well without treatment
- pumping of contaminated ground water, treatment and then disposal in an underground injection well
- pumping of contaminated ground water and treatment by evaporation

Source Treatment:

- soil vapor extraction
- solidification/stabilization
- in-situ vitrification
- incineration

Alternatives providing for direct treatment or removal of contaminated soils below the water table were eliminated for a number of reasons. For one, treatment of soils below the water table would normally require dewatering of the aquifer below the site prior to excavation. Dewatering would require installation of a containment barrier and disposal of a large volume of contaminated ground water. Because of the time needed for the injection well construction, the contaminated ground water from dewatering would have to be disposed of commercially. The nearest commercial deep well is in Ohio, so this disposal would be expensive and add transportation hazards. In addition, ground water pump and treatment alternatives may address readily leachable contaminants by gradual removal by natural ground water flushing. Contaminants that do not leach out will be unavailable for direct ingestion because they are below the water table. Therefore, the source removal and treatment alternatives only address contaminated subsurface soils and materials above the water table and highly contaminated materials below the water table that can be handled by localized dewatering.

The areal extent and depth of source treatment above the water table will be determined by soil cleanup action levels (CALs). The extent and period of operation of ground water treatment measures will be determined by ground water CALs. Surface sediments will be scraped up in the area shown in Figure 12 to a depth that will leave the remaining sediments below the soil CALs. The CALs are defined in Section X, and includes attainment of MCLs in the ground water. The expected areal extent of source and surface sediment remediation required is shown in Figure 12. The expected aerial extent of ground water remediation is shown in Figure 13. Applicable, or relevant and appropriate requirements (ARARs) for the various alternatives are summarized in Tables 6, 7 and 8 in the Appendix. The fourteen alternatives are summarized below, including the status of compliance with major ARARs.

Alternative 1: No Action

By law, U.S. EPA is required to consider the no-action alternative. No action would be taken to address the source, the contaminated ground water or surface water. The source would continue to cause contamination of the ground water and surface waters. The contaminated ground water would continue migrating off-site and may eventually affect nineteen ground water wells.

Alternative 2: Access Restrictions With Cap

This alternative consists of the construction of a RCRA compliant multi-layer cap over the entire site, an area of approximately 302,000 square feet. The cap would include a low-permeability barrier layer to prevent vertical migration of water, a lateral drainage layer and a vegetative cover, as shown in Figure 14. A concrete conduit would be installed in the ditch to carry surface water past the site.

The scraped contaminated sediments (estimated to be 1,200 cubic yards) and areas of isolated soil contamination would be excavated and transported to an off-site landfill for disposal.

Ground water use restrictions would be placed in the area shown in Figure 11. The two wells on the Gary Airport property would be replaced by a connection to the municipal water system.

This and all the remaining alternatives would include installation of a six foot chain link fence with 3-strand barbed wire around the site, installing warning signs, and imposition of deed restrictions.

Ground water and surface water migration would be monitored regularly.

-12-a

Figure 12

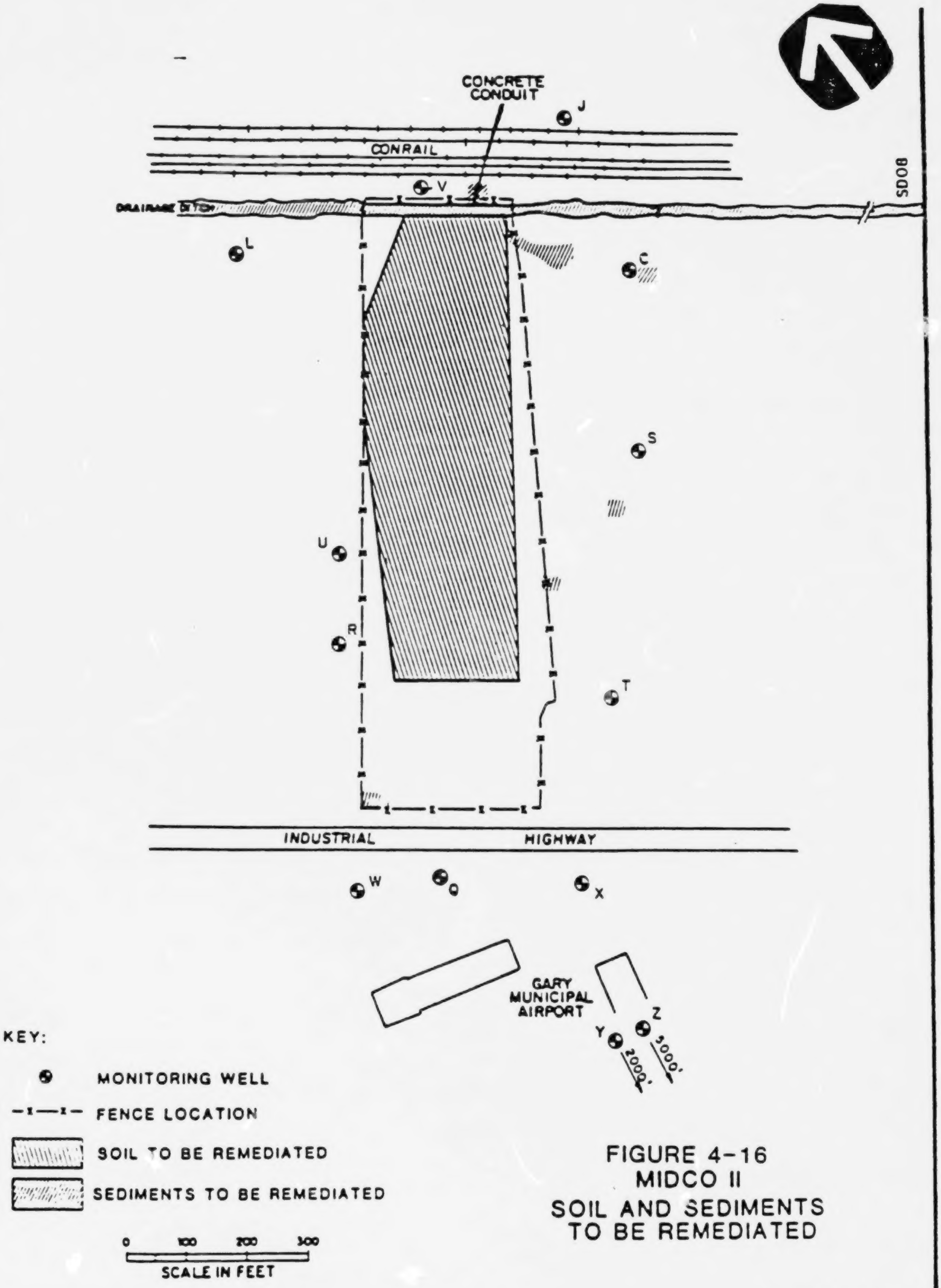

CONCRETE CONDUIT
J
CONRAIL
V
DRAINAGE DITCH
5008
L
C
S
U
R
T
INDUSTRIAL HIGHWAY
W
Q
X
GARY MUNICIPAL AIRPORT
Y
Z
2000'
3000'
KEY:
MONITORING WELL
FENCE LOCATION
SOIL TO BE REMEDIATED
SEDIMENTS TO BE REMEDIATED
0
100
200
300
SCALE IN FEET

FIGURE 4-16
MIDCO II
SOIL AND SEDIMENTS
TO BE REMEDIATED

Dames & Moore

- 12 - 6

Figure 13

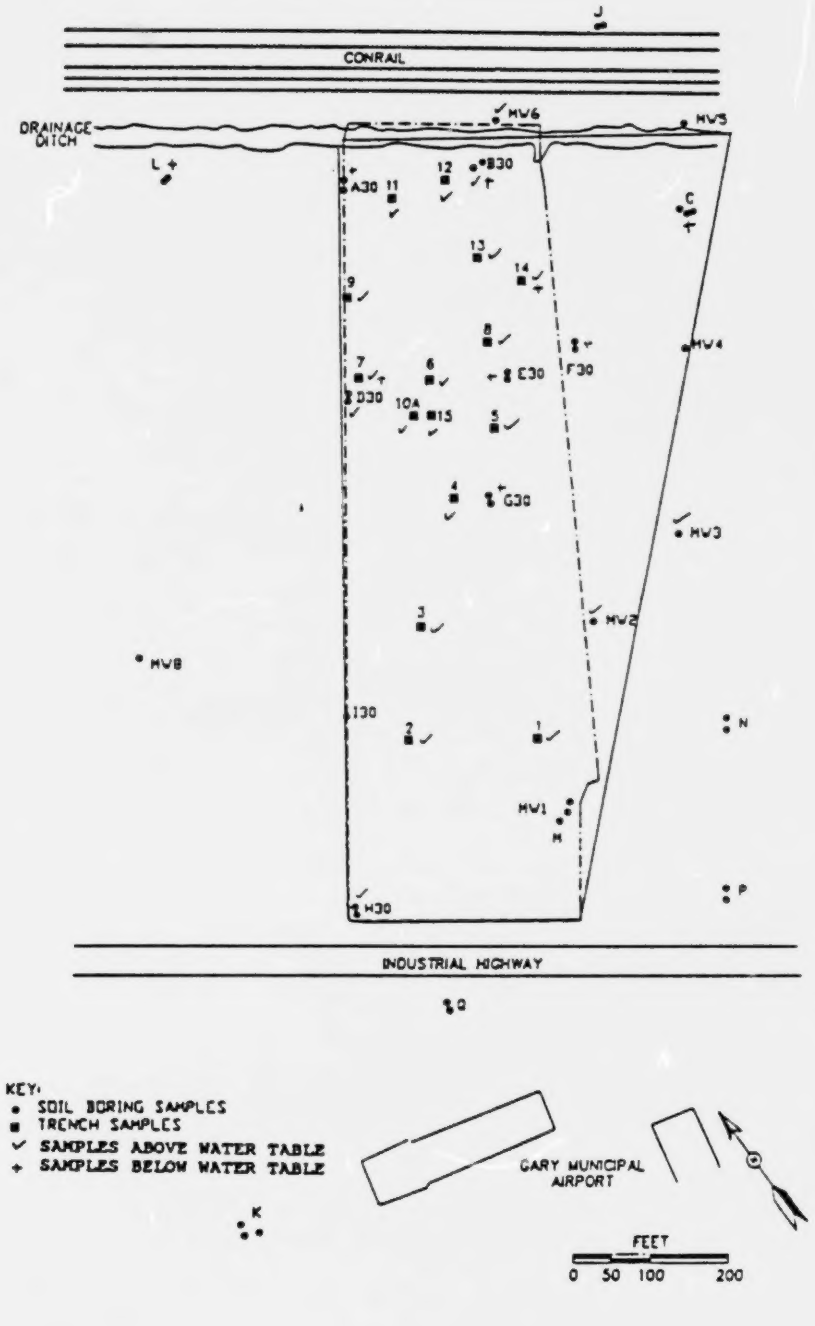

CONRAIL
J
DRAINAGE DITCH
HW6
HW5
L
A30
11
12
B30
C
13
14
9
8
F30
HW4
7
6
E30
D30
10A
15
5
4
G30
HW3
HW2
3
HW8
I30
2
1
N
HW1
M
H30
P
INDUSTRIAL HIGHWAY
Q
KEY:
● SOIL BORING SAMPLES
■ TRENCH SAMPLES
✓ SAMPLES ABOVE WATER TABLE
+ SAMPLES BELOW WATER TABLE
GARY MUNICIPAL AIRPORT
K
FEET
0 50 100 200

FIGURE 1-31
MIDCO II
GROUND WATER TO BE REMEDIATED

-12-C

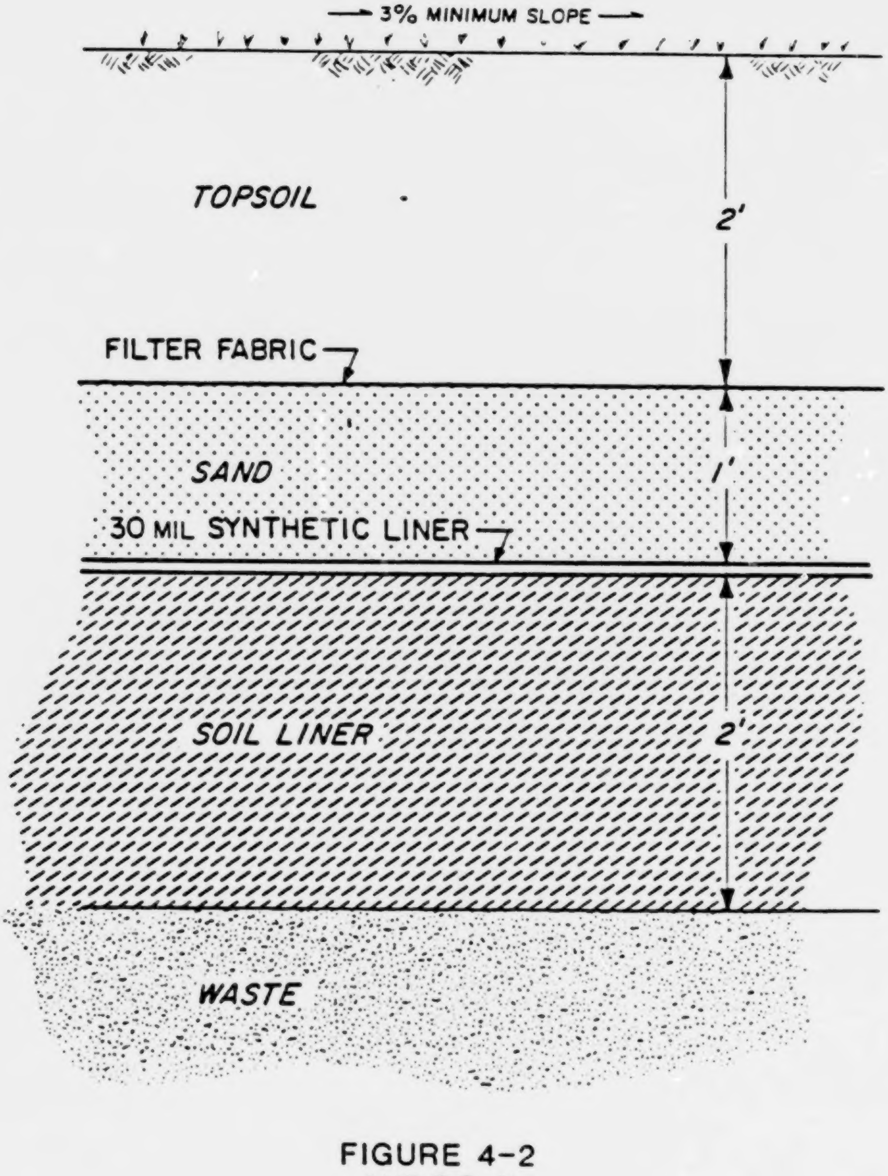

3% MINIMUM SLOPE
TOPSOIL
2'
FILTER FABRIC
SAND
1'
30 MIL SYNTHETIC LINER
SOIL LINER
2'
WASTE

FIGURE 4-2
MIDCO II
ALTERNATIVE 2
RCRA MULTILAYERED CAP

Dames & Moore

1. Relevant and Appropriate Requirements:

This alternative would be consistent with hazardous waste landfill closure requirements of the Resource Conservation and Recovery Act (RCRA) (40 CFR 264.111, 264.116, 264.117, 264.310), and ground water monitoring requirements of RCRA (40 CFR 264.97, and 264.99). However, it would not be consistent with the Primary Drinking Water Regulations (40 CFR 141) or the RCRA corrective action requirements (40 CFR 264.100) because contamination from the site would continue to cause exceedance of the MCLs in off-site ground water. It also would not be consistent with the Ambient Water Quality Criteria (AWQC) for protection of aquatic life because the contaminated ground water would recharge surface waters and cause exceedance of the AWQC.

2. Applicable Requirements:

The off-site disposal of contaminated sediments would have to be in compliance with U.S. EPA's off-site policy and all applicable RCRA, and Department of Transportation (DOT) regulations.

Alternative 3: Containment

A clay slurry wall would be installed around the area where clean-up action levels (CALs) are exceeded in soils above the water table and for ground water. The wall would be keyed into the material confining layer located 48 feet below the surface, and would be approximately 36 inches wide and 2,900 feet long.

Because of the high salt content and other contaminants at the site, bench scale tests would be performed in order to determine the formulation for the slurry. Bentonite clay may be affected by the high salinity, so attupulgite clay may be used instead.

A multi-layer cap as described in Alternative 2 would be placed over the area inside the slurry wall. A conduit would be installed as in Alternative 2. Contaminated sediments would be scraped and contained within the cap and slurry wall. Areas of discontinuous soil contamination would be excavated and contained within the cap and slurry wall. An extraction well would be placed in the containment area to lower the ground water inside the wall by approximately 0.5 feet to insure an inward ground water gradient. Initially, this would require disposal of approximately 500,000 gallons of contaminated ground water. This would be disposed of in the nearest commercial deep well.

As with Alternative 2, the site would be fenced and posted, deed restrictions imposed, and a monitoring program implemented.

1. Relevant and Appropriate Requirements:

This alternative would be consistent with RCRA hazardous waste landfill closure requirements. Because the ground water outside the slurry wall would meet the CALs, this alternative would also be consistent with RCRA corrective action requirements, and the Primary Drinking Water Regulations. After containment of the Midco II source, surface water would shortly meet the AWQC (unless other sources are present).

2. Residual Risks:

Because no treatment is involved in this alternative, the residuals contained within the slurry wall and cap would be the same as presently at the site. The risks involved in case the cap and slurry wall are damaged or if residential development occurred on the site, would be the same as the present site risks.

Alternative 4A: Ground Water Pumping and Deep Well Injection

This and all other alternatives treating the ground water includes installation and operation of ground water, extraction wells to intercept the contaminated ground water that exceeds the CALs. The results of a preliminary model, estimate that four extraction wells should be installed to recover ground water as shown in Figure 15. The total estimated pumping rate for the four wells is 28 gpm. The extraction wells would be operated until ground water CALs are met in all portions of the Calumet aquifer affected by the site. Because the contaminated ground water would be contained, AWQC would shortly be attained in surface water, unless prevented by other sources.

A Class I hazardous waste underground injection well would be installed. The injection zone would be located approximately 2,250 feet below the surface in the Mount Simon aquifer. The underground injection operation may be combined with the Midco I remedial action if this determined to be cost effective. The 9th Avenue Dump remedial action may also include utilizing the deep well from Midco for disposal of saline waste water. In these cases, the combined treatment and disposal activities will constitute an on-site action for purposes of the off-site policy, with the exception that the transported wastes must be manifested.

The combined treatment and disposal can be considered an on-site action pursuant to Section 104(d)(4) of CERCLA because the following criteria are met (Interim RCRA/CERCLA Guidance on Non-Contiguous Sites and On-site Management of Waste and Treatment Residue. Porter. March 27, 1986. OSWER Directive 8347-01):

1. The sites are close together:

2. The wastes are compatible:

3. The wastes will be managed as part of a highly reliable long-term remedy;

4. The incremental short-term impacts to public health and the environment will be minimal.

14-a

Figure 15

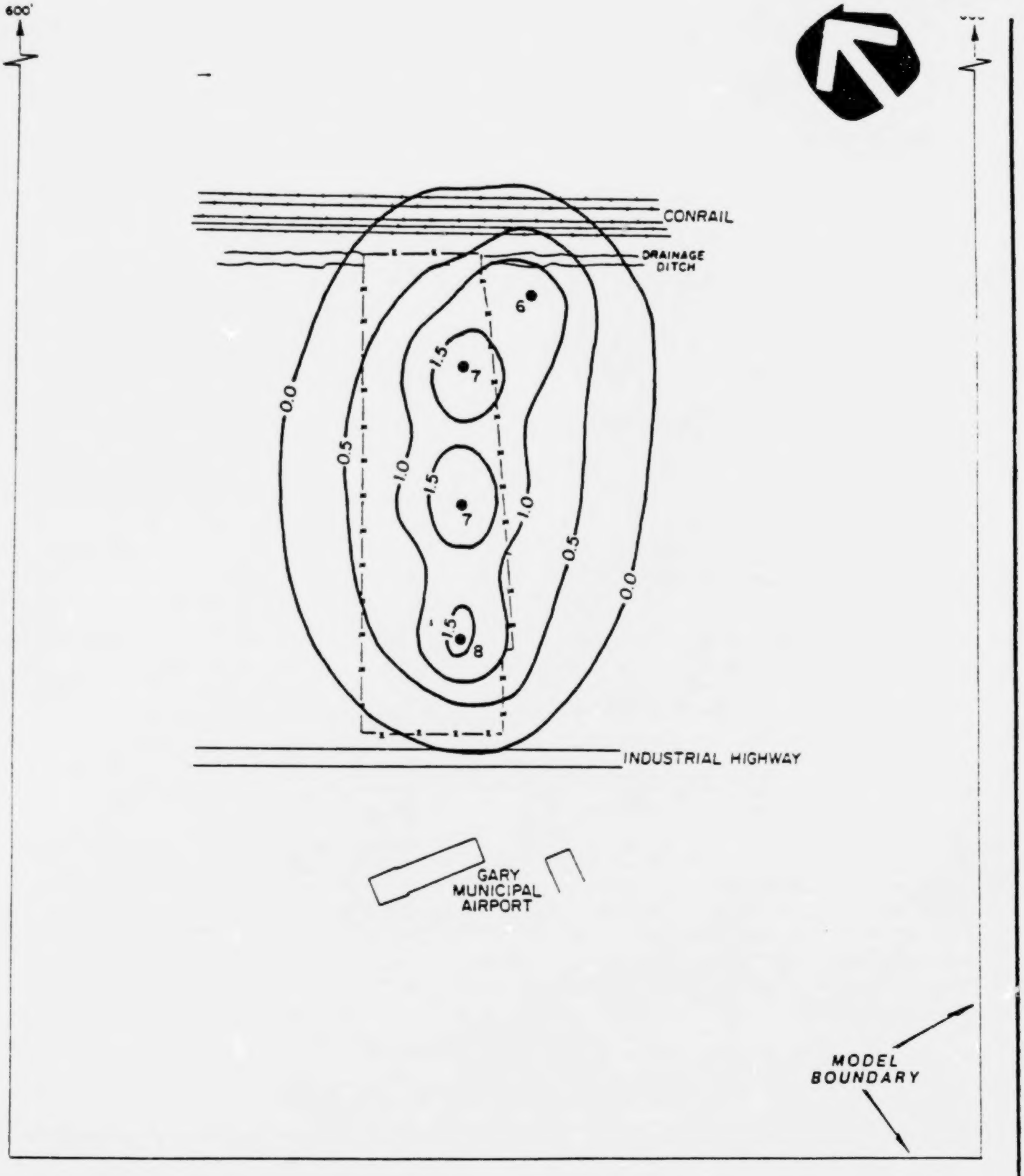

600'
CONRAIL
DRAINAGE DITCH
6
1.5
7
0.0
0.5
1.0
1.5
7
1.0
0.5
0.0
1.5
8
INDUSTRIAL HIGHWAY
GARY MUNICIPAL AIRPORT
MODEL BOUNDARY
●7 INDICATES WELL LOCATION AND PUMPING RATE GALLONS PER MINUTE
1.0 INDICATES DRAWDOWN CONTOUR IN FEET
0 200 400
SCALE IN FEET

FIGURE 4-4
MIDCO II
DRAWDOWNS (FEET) AND
PUMPING WELL LOCATIONS

Dames & Moore

1. Applicable Requirements:

The deep well injection must be in compliance with the Land Disposal Restriction (LDR) requirements of 40 CFR 268 and 40 CFR 148. The following listed hazardous wastes have been disposed of on the site and are contained in the contaminated subsurface soils, ground water and surface sediments: F001, F002, F003, F005, F007, F008, F009.

For this reason, before the ground water can be injected without treatment, a petition to allow land disposal of waste prohibited under Subtitle C of 40 CFR 268, must be granted by the U.S. EPA Administrator pursuant to 40 CFR 268.6 and 40 CFR 148 Subpart C. This petition must demonstrate that there will be no migration of hazardous constituents from the injection zone for as long as the wastes remain hazardous.

A cross section of the geology of this area is shown in Figure 16. The injection zone in the Mount Simon aquifer is separated by geological formations from drinking water aquifers. Nearby class I underground injection wells that are presently operating, have submitted petitions pursuant to 40 CFR 268.6. These petitions are presently under review by U.S. EPA.

The injection well must be constructed, installed, tested, monitored and operated, closed and abandoned in accordance with U.S. EPA requirements and conditions pursuant to 40 CFR 144 and 146. In addition, reporting requirements must be in accordance with 40 CFR 144 and 146. Contaminated sediments will be scraped and disposed off-site in accordance with the U.S. EPA off-site policy and applicable RCRA and DOT requirements.

The remedial action may also require responses to operational problems, and implementing corrective actions pursuant to 40 CFR 146.64, 144.67, 144.12, 144.51(d) and 144.55. This may include requirements for construction, monitoring, reporting, well plugging and injection well closure as necessary to prevent movement of any contaminant into an underground source of drinking water (U.S.D.W.)(40 CFR 144.3), due to operation of the injection well. This may also require implementation of remedial actions to restore any U.S.D.W. that becomes contaminated as a result of operation of the injection well, to background water quality to the extent practical, pursuant to Section 3004(u) and 3008(h) of the 1984 Hazardous and Solid Waste Amendments.

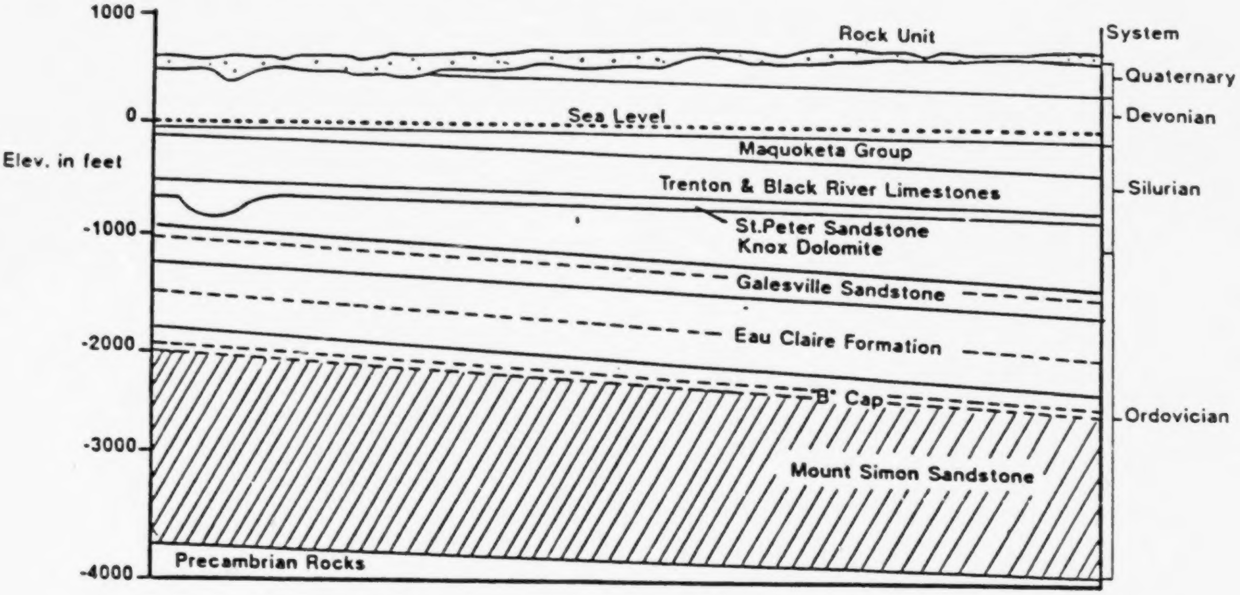
2. Residual Risks and Relevant and Appropriate Requirements:

Natural attenuation and flushing of the source would occur during operation of the ground water extraction system. However, some hazardous substance residuals would remain in the subsurface soils. The residual risks cannot be determined at this time. Therefore, a site cover would be placed over the contaminated soils that would be consistent with RCRA hazardous waste landfill closure requirements (40 CFR 264.111, 264.116, 264.117, 264.310). The site would be fenced, deed restrictions imposed, and a ground water monitoring system implemented consistent with RCRA requirements.

15-a

Figure 16

Figure 7, Lake County Geology



1000
0
Elev. in feet
-1000
-2000
-3000
-4000
Rock Unit
System
Quaternary
Sea Level
Devonian
Maquoketa Group
Trenton & Black River Limestones
Silurian
St.Peter Sandstone
Knox Dolomite
Galesville Sandstone
Eau Claire Formation
"B" Cap
Ordovician
Mount Simon Sandstone
Precambrian Rocks

Alternative 4C: Ground Water Pumping, Treatment and Either Deep Well Injection or Reinjection into the Calumet Aquifer

This alternative is the same as alternative 4A except that the contaminated ground water would be treated to the extent necessary to meet U.S. EPA requirements prior to the underground injection. For this alternative, U.S. EPA approval of the underground injection well would be required, but no petition demonstration would be needed.

Prior to the deep well injection, Land Disposal Restrictions (LDR) treatment standards would be met. Treatment requirements for listed wastes F001, F002, F003, and F005 (40 CFR 268), would likely require an air stripper and a liquid-phase granular activated carbon polish system. Treatment may also be required for cyanide, chromium, lead and nickel to meet the proposed treatment standards for listed wastes F007, F008 and F009 (F.R., Vol. 54, No. 7.). The LDR Treatment standards are listed in Tables 19 and 20 (the standards for non-wastewaters would be applicable to contaminated ground water).

It is anticipated that treatment units would be designed for an average flow of 28 gpm. Air emissions from the air stripper would be controlled most likely with a carbon canister. The degree of air emissions control required is defined in Section X. Treatment residuals, which may include spent carbon and metals sludge would be disposed of off-site in accordance with U.S. EPA's Off-site Policy and applicable RCRA and DOT regulations.

As with alternative 4A, the treatment and underground injection well system may be combined with Midco I.

Alternatively, the ground water could be treated and then reinjected into the Calumet aquifer if reinjection is conducted in a manner that will prevent spreading of the salt plume. At the end of the pumping, treatment and reinjection operation, the ground water at the site must meet the ground water CALs (Section X). The goal of the remedial actions is to restore the ground water quality. Normally, this would require that the remedial action also reduce secondary (non-hazardous) contaminants such as total dissolved solids (TDS) either to background levels or to Secondary Maximum Contaminant Levels (40 CFR 143). However, at Midco II, since there are nearby contaminant sources, high levels of TDS would be left in the ground water at the site at the completion of remedial actions.

Alternative 4E: Ground Water Pumping and Evaporation

A ground water extraction system would be installed and operated in the same manner as in alternatives 4A and 4C. However, the contaminated ground water would be treated by evaporation, instead of by separate treatment operations combined with deep well injection. All contaminants would be concentrated into treatment residuals that would have to be disposed of off-site in accordance with U.S. EPA's off-site policy and applicable RCRA and DOT requirements. The residuals will include blow down and salt cake. In addition, air stripping and carbon adsorption may be required prior to discharge of the condensate. Air emissions will have to be controlled to meet the criteria described in Section X.

The blow down and carbon residuals would likely be commercially incinerated. Cyanide and metals in the ground water would likely be concentrated in the salt cake. If this occurs, land disposal of the salt cake would likely not be allowed under the Land Disposal Restrictions regulations without prior destruction of the cyanide and treatment of metals (F.R., Vol. 53, No. 7). See Table 20.

The final site cover and handling of contaminated sediments would be the same as in alternatives 4A and 4C.

The evaporation system may be combined with Midco I.

Alternative 5A: Excavation above the Ground Water Elevation and Landfilling

This alternative and alternatives 5C, 5E and 5G treat the source and surface sediments, but not the ground water.

1. Excavation and Off-Site Disposal:

As part of the Feasibility Study a risk assessment was conducted to estimate the risks to off-site residents and airport workers during excavation activities due to volatilization of organic compounds and fugitive dust emissions. Using very conservative assumptions, it was estimated that the carcinogenic risk to the nearest residents may be 5.05×10^{-8} and the risk to airport workers may be 1.1×10^{-6}. Because these risks are low, it is acceptable to conduct the excavation activity without prior soil vapor extraction (SVE) as long as adequate protection is provided to on-site workers, emissions are monitored, measures are taken to minimize emissions during excavation, and provisions are made to shut down the operation in case atmospheric conditions may cause levels of exposure exceeding the criteria defined for air emissions in Section X.

An estimated 34,600 cubic yards of contaminated soil above the water table and 500 cubic yards of contaminated surface sediments would be excavated and disposed of off-site. All off-site disposal would be required to comply with U.S. EPA's off-site policy and applicable RCRA and DOT regulations. LDRs under 40 CFR 268 may not allow this alternative because cyanide, metals and volatile organic compounds would not be treated (see standards for non-wastewaters in Tables 19 and 20).

2. Site Cover and Ground Water:

The site would be restored to grade with uncontaminated fill. A conduit would be installed in the ditch along the site. Over a long period of time, ground water may attenuate to below CALs. However, in the meantime, the ground water at the site would be highly contaminated and would continue to migrate off-site. It may eventually affect ground water in the area shown in Figure 11. Ground water usage restrictions would be imposed in this area, and the two wells on Gary Airport property would be replaced by connections to the municipal water system. This action would be consistent with RCRA ground water monitoring requirements. It would be inconsistent with RCRA corrective action requirements and Primary Drinking Water Standards because MCLs would be exceeded in off-site ground water. The AWQC may be exceeded in surface waters due to off-site migration of the ground water.

The site would be fenced, deed restrictions imposed and ground water monitoring implemented as in Alternative 2.

Alternative 5C: Excavation Above Water Table, Incineration and Ash Solidification

Incineration:

As with Alternative 5A, measures would be taken to insure that air emissions during excavation and handling of the subsurface material do not exceed the criteria for air emissions defined in Section X.

Following excavation, the contaminated subsurface and sediment material would be incinerated. RCRA regulations become applicable to the material excavated and treated. It is anticipated that the incinerator would be a transportable, rotary-cell type, approximately thirty-eight feet long with a ten-foot inner diameter.

The incinerator is expected to have a capacity of approximately 17.5 tons per hour. A secondary combustion chamber would be used to assure complete destruction of the wastes, and a caustic scrubber would neutralize acidic flue gases and control particulate emissions. The incinerator would have to meet the testing and performance standards in 40 CFR 264.341, 264.351, 264.343, 264.342, 7611.70 and special State of Indiana requirements including a test burn and extensive stack sampling.

The incineration should destroy nearly all the organic compounds and cyanide. The inorganics (other than cyanide) would largely remain in the ash. The remaining lifetime carcinogenic risk in the ash due to direct soil ingestion would be approximately 2.77×10^{-4} due to arsenic.* However, these levels of arsenic represent background concentrations. The remaining cumulative chronic non-carcinogenic risk index due to soil ingestion would be 2.8 due primarily to arsenic, antimony, beryllium and chromium (VI) in the soil. The subchronic risk index would remain above 1.0 for toluene, copper, selenium and cyanide because ground water would not be remediated. The metals in the ash may be in a form that would leach to a significant degree. However, past leaching from the soil has caused ground water contamination by a number of metals.

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* From addendum to Public Comment Draft Feasibility Study, March 7, 1989. Table 4-21.

The incineration at Midco II may be combined with the incineration at the nearby Ninth Avenue Dump site. For purposes of RCRA and the U.S. EPA off-site policy, the combined action would be considered one site.

The incineration process must satisfy the LDRs for non-wastewaters for listed wastes No. F001, F002, F003, F005, F007, F008, F009 (see Tables 19 and 20). However, a capacity variance is in effect for waste categories F001, F002, F003 and F005 in soil, waste and debris until November 1990.

Solidification:

In addition to the risks remaining from the ash, the concentrations of some inorganic compounds (arsenic, chromium and lead) in the ash will be similar to concentrations in some listed hazardous wastes for which treatment is required prior to land disposal. This is shown in Table 9 in the Appendix. For these reasons, solidification/stabilization (S/S) of the ash will be required following the incineration. Following S/S, the solidified mass must meet the LDR treatment standards (see Table 19 and 29), or meet standards for a Treatability Variance, if this is approved pursuant to 40 CFR 268.44. In addition, if the ash is a hazardous wastes by characteristic, D004, D005, D006, D007, D008, D009 or D010, LDRs for these wastes may be applicable at the time of the action.

Site Cover and Ground Water:

The incinerated/solidified material would be placed on-site. The design of the final cover would depend on the results of the leachate tests on the ash or solidified material. If the waste is delistable, a two-foot soil cover would be placed over the site. If not, a final cover in compliance with applicable RCRA landfill closure requirements would be installed.

As in Alternative 5A, ground water monitoring, usage restrictions, municipal water connections, deed restrictions, and access restrictions would be implemented. This alternative would be inconsistent with RCRA corrective action requirements and Primary Drinking Water Regulations.

Alternative 5E: Solidification

Two methods of mixing for solidification are available. One involves excavation, mixing above ground and replacement of the solidified material on-site; the second involves in-situ addition of reagents and mixing.

Using either method of mixing, measures would be taken to insure that air emissions during excavation and solidification do not exceed the criteria for the air emissions defined in Section X.

1. Above Ground Mixing:

Subsurface materials above the ground water table and surface sediments that exceed soil CALs would be excavated, mixed with water, binder and reagents in a tank and then placed back on site to cure. It is anticipated that the contaminated materials would be fed to the mixer at a maximum rate of 75 cubic yards per hour. Large items such as stumps would be sifted out and sandwiched inside layers of solidified material on the site.

Once the contaminated subsurface materials and sediments are excavated and treated, the RCRA regulations become applicable. Pursuant to 40 CFR 268, land disposal of the treated material would not be allowed unless the LDR treatment standards are attained (see Tables 19 and 20), or Treatability Variance treatment standards are attained (see Table 21) (40 CFR 268.44). Until November 1990, there are no LDR treatment standards in effect for waste categories F001, F002, F003 and F005 in soil, waste and debris because of a capacity variance. The proposed LDR treatment standard for cyanide requires destruction of cyanide rather than reduction in mobility.

Because it may be impossible to meet the LDR treatment standards for cyanide by S/S, and because existing available data do not demonstrate that full scale operation of S/S can attain the LDR treatment standards consistently for all soil and debris at this site, this alternative will comply with the LDRs through a Treatability Variance. The required treatment standards (based on results of Toxicity Characteristic Leaching Procedure (TCLP) Tests) are summarized in Table 21. Constituents that are not listed in Table 21 should be reduced in mobility by 90% based on TCLP tests.

Regulations applicable to hazardous wastes by characteristic (D003, D004, D005, D006, D007, D008, D009, D010) may become applicable to the operation by the time S/S is implemented. If only VOCs exceed the Land Disposal Restriction Standards, then a soil vapor extraction operation would be conducted to assure attainment of these standards.

2. In-situ Mixing:

As an alternative to excavation and solidification, the subsurface soil to be remediated would be solidified in-situ. It is anticipated that the system would utilize a crane-mounted mixing system. The mixing head would be enclosed in a bottom-opened cylinder to allow closed system mixing of the treatment chemicals with the soil. The bottom-opened cylinder would be lowered onto the soil and the mixing blades would be started, moving through the depth in an up and down motion, while chemicals are introduced. Vapors and dust would be pulled into the vapor treatment system, composed of a dust collection system followed by in-line activated carbon treatment. An induced draft fan would exhaust the treated air to the atmosphere. At the completion of a mixing, the blades would be withdrawn and the cylinder removed. The cylinder would then be placed adjacent to and overlapping the previous cylinder. This would be repeated until the entire area has been treated. The surface sediments would be scraped up and consolidated on-site for solidification.

Using in-situ mixing, the LDRs would not be applicable nor considered to be relevant and appropriate. The S/S will be considered successful if it reduces the mobility of contaminants so that leachate from the solid mass will not cause exceedance of the Cleanup Action Levels in the ground water (see Section X). If leaching of VOCs may cause exceedance of ground water CALs, but leaching of other constituents will not cause exceedance of ground water CALs (based on the treatability tests); then a soil vapor extraction operation (as in Alternative 5A) will be conducted to assure that leaching of VOCs does not cause exceedance of these CALs.

3. Residual Risks:

If the solidification/stabilization operation is successful, the exposures due to direct soil ingestion and leaching to ground water should be nearly eliminated.

Using solidification, the mobility of hazardous constituents would be reduced through binding or entrapment of hazardous constituents in a solid mass with low permeability that resists leaching. Some volatile organic compounds will be driven off during the process, but these can be controlled so that the effects on off-site and on-site persons would be negligible. S/S has been selected as the best demonstrated available technology (BDAT) or part of a BDAT for treatment of a number of RCRA hazardous wastes for the Land Disposal Restrictions (40 CFR 268). These include the following listed hazardous wastes: F006, K001, K015, K022, K048, K049, K050, K051, K052, K061, K086, K087, K101. These listed hazardous wastes contain the following hazardous constituents: cadmium, chromium, lead, nickel, silver, arsenic, and selenium (40 CFR 268, promulgated August 17, 1988). S/S is considered a potentially applicable technology for treatment of hazardous wastes by characteristic numbers D004, D005, D006, D007, D008, and D010, which contain arsenic, barium, cadmium, chromium, lead, and selenium (F.R., Vol. 54, No. 7, p. 1098-1099).

The S/S process has weaknesses. Some constituents interfere with the bonding with waste materials. This includes high organic content (>45% by weight), semivolatile organic compounds greater than 1.0%, cyanide greater than 3,000 ppm, and high oil and grease (>10%). In addition, halide may retard setting, and soluble manganese, tin, zinc, copper and lead salts increase the leachability potential (Technology Screening Guide for Treatment of CERCLA Soils and Sludges, EPA/540/2-88/004. Sept. 1988). Midco II subsurface materials contain halides, and elevated zinc, manganese, copper and lead. Midco II differs from Midco I in that Midco II does not contain the same high concentrations of semivolatile compounds and cyanide.

In addition, the long term integrity of the solidified material is not well documented because few projects have been in place for long periods of time. This is of concern because organic constituents are usually not considered to be treated by this process but only encapsulated. There is very little data available on the applicability of S/S to cyanide wastes. In one study, the mobility of arsenic was increased by orders of magnitude by the S/S. Chromium and arsenic are difficult to solidify and may require specialized binders. Organic lead may not be effectively treated by S/S (F.R., Vol. 54, No. 7, pp. 1098, 1099).

Therefore, U.S. EPA can not be sure how successful S/S will be at Midco II until treatability tests are completed. These tests are being initiated. In addition, treatability tests are needed to determine the proper formulation for the solidification reagents.

4. Final Site Cover:

If the subsurface materials are excavated, RCRA hazardous waste regulations become applicable, and the final site cover must meet RCRA landfill closure requirements, unless the waste is delisted pursuant to 40 CFR 260.22. However, RCRA does not presently utilize leach testing procedures in the delisting of organic compounds. The final site cover must also protect the solidified material from degradation due to environmental factors such as acid rain and the freeze-thaw cycle.

If in-situ mixing is used, RCRA landfill closure requirements are not applicable. However, these requirements may be considered relevant and appropriate by U.S. EPA depending on the results of the treatability study. At a minimum, the cover must protect the solidified material from environmental degradation, minimize maintenance, promote drainage, and minimize erosion.

5. Ground Water and Access:

Ground water usage restrictions, well connections, deed restrictions, access restrictions and monitoring would be implemented as in alternative 5A. This alternative would be inconsistent with RCRA corrective action requirements and Primary Drinking Water Regulations.

Alternative 5G: In-Situ Vitrification

In this thermal treatment process, a square array of four electrodes are inserted into the ground to the desired treatment depth of 4.5 feet. A conductive mixture of flaked graphite and glass frit is placed among the electrodes as a path for the current. Voltage is applied to the electrodes to establish a current in the starter path. The resultant power heats the starter path and surrounding soil up to 3600°F. The soil becomes molten at temperatures between 2000° and 2500°F. As the vitrified zone grows it incorporates non-volatile elements and destroys organic compounds by pyrolysis. Pyrolyzed products move to the surface where they combust. A hood over the process collects off-gases for treatment. The hood remains over the melt until gassing stops, in approximately four days. Thus, two hoods are required for sequential batch processing. The vitrified mass is left in place and any subsidence is backfilled with clean fill and seeded. In addition, contaminated sediments would be scraped and transported to the site for vitrification.

The advantages of in-situ vitrification include that excavation is not required (except for surface sediments, which would be scraped up and consolidated on-site for vitrification), air emissions are controlled in place, organic compounds are destroyed and inorganic compounds are incorporated into a glassy solid matrix resistant to leaching and more durable than granite or marble (Technology Screening Guide for Treatment of CERCLA Soils and Sludges, EPA/540/2-88/004, Sept. 1988).

Disadvantages of in-situ vitrification include that although it has been tested in pilot studies, it has not been demonstrated in a full scale commercial application. In addition, the commercial availability of the equipment is limited. The presence of ground water only five feet below the surface severely limits the economic practicability because of the energy expended in driving off water. The presence of buried metals and combustible solids below the surface may also cause problems in the operation (Technology Screening Guide for Treatment of CERCLA Soils and Sludges, EPA/540/2-88/004, Sept. 1988).

Because the organic compounds are destroyed and inorganic compounds incorporated into a solid mass resistant to leaching, it is expected that the treated material will be delistable. If tests show that the residue is delistable, only a soil cover would be placed over the site.

Ground water usage restrictions, well connections, deed restrictions, access restrictions and monitoring would be implemented as in alternative 5A. This alternative would be inconsistent with RCRA corrective action requirements and Primary Drinking Water Regulations.

Alternative 6: Containment with Soil Vapor Extraction and Solidification

This alternative combines the source treatment measures in alternative 5E with the containment measures in alternative 3. The advantage of this alternative over alternative 3 alone is that the risks from residual subsurface soil contamination within the containment barrier would be nearly eliminated. The contaminants in the ground water would remain but they would be contained within the slurry wall.

Should the slurry wall fail, the ground water in the area shown in Figure 13 may eventually be affected. Although the contamination may eventually attenuate, the risks from ingestion of ground water on the site itself would remain very high for a long time.

If successful, the S/S process would nearly eliminate the remaining risks due to the source.

Alternative 7: Ground Water Pumping and Deep Well Injection with Solidification

This alternative combines the source treatment measures in alternative 5E with the ground water treatment measures in alternative 4A.

At the conclusion of this action, the site would be close to meeting RCRA clean closure requirements. However, long-term monitoring and maintenance would be required because the long-term effectiveness of S/S is not well documented.

Alternative 8: Ground Water Pumping, Treatment and Deep Well Injection with Solidification

This alternative combines the source treatment measures in alternative 5E with the ground water treatment measures in alternative 4C.

At the conclusion of this action, the site would be close to meeting RCRA clean closure requirements. However, long-term monitoring would be required because the long-term effectiveness of S/S is not well documented.

Alternative 9: Ground Water Pumping and Evaporation with Solidification

This alternative combines the source treatment measures in alternative 5E with the ground water treatment measures in alternative 4E.

At the conclusion of this action, the site would be close to meeting RCRA clean closure requirements. However, long-term monitoring would be required because the long-term effectiveness of S/S is not well documented.

IX. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

In selecting the final remedial actions for Superfund sites, U.S. EPA considers the following nine criteria:

1. Overall Protection of Human Health and the Environment: addresses whether or not a remedy provides adequate protection, and describes how risks are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

2. Compliance with ARARs: addresses whether or not a remedy will meet all of the applicable or relevant and appropriate (ARARs) requirements of other environmental statutes and/or provide grounds for invoking a waiver.

3. Long-term effectiveness and permanence: refers to the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

4. Reduction of toxicity, mobility, or volume (TMV): is the anticipated performance of the treatment technologies a remedy may employ.

5. Short-term effectiveness: involves the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

6. Implementability: is the technical and administrative feasibility of a remedy, including the availability of goods and services needed to implement the chosen solution.

7. Cost: includes capital and operation and maintenance costs.

8. Support Agency Acceptance: indicates whether, based on its review of the RI/FS and Proposed Plan, the state agency (the Indiana Department of Environmental Management) concurs, opposes, or has no comment on the preferred alternative.

9. Community Acceptance: will be assessed from the public comments received.

These nine criteria incorporate factors required to be addressed in the remedy selection process in SARA Section 121.

A comparison of the fourteen alternatives using the nine criteria is included in Tables 10, 11 and 12. A comparison of costs among the fourteen alternatives is in Table 13. Table 14 compares some major factors considered in the effectiveness evaluation among the fourteen alternatives. These Tables are included in the Appendix.

The no-action alternative (1) is unacceptable because ARARs for groundwater and surface waters would be exceeded and human health and environmental risks from continued air emissions and groundwater migration will be unacceptable.

Alternatives that address only the source (alternatives 2, 5A, 5C, and 5G) are unacceptable because although groundwater and surface water contamination may eventually attenuate, this will take many years (estimate 107-175 years). In the meantime, ARARs for the groundwater and surface water would be exceeded, the groundwater plume would eventually affect a large area, and biota may be adversely affected by groundwater recharge to surface waters and air emissions.

The containment alternatives 3 and 6 would provide protection to human health and the environment for as long as the site cap and slurry wall are maintained. However, the high salt and organic concentrations may affect the permeability of the slurry wall, resulting in the need to replace it in the long term. If future development occurs or the cap or slurry wall are damaged, the resulting health risks may be similar to no action for alternative 3, and to alternatives addressing only the source for alternative 6. Costs for remedying failure would be similar to but higher then the original installation. In that case, the total cost for a containment alternative would be similar to the cost for remedial actions that treat both the source and the ground water.

Alternatives that include only treatment of the ground water (4A, 4C, 4E) would attain a considerable degree of permanent protection. Contaminants presently in the ground water and contaminants that are flushed into the ground water would be reduced in toxicity, mobility, and volume (TMV) by operation of the ground water treatment system over a long period of time. The site cover and access restrictions would protect against on-site direct ingestion and direct contact risks.

At the completion of the ground water action, residual contamination will remain under the site cover, although it will be reduced from the present conditions. It is uncertain what residual risks will remain. It is possible that mobile contaminants will remain under the cover after completion of the ground water treatment actions. If the cover is subsequently disturbed or degraded, these residuals will again cause ground water contamination. Even if relatively mobile components, such as volatile organic compounds and cyanide are flushed from the soil, the residual risks due to direct ingestion in case of future development would be: 2.7×10^{-4} lifetime carcinogenic risk due to arsenic, and a chronic non-carcinogenic index of 2.8. In addition subchronic risks from copper would likely remain. In addition, arsenic, lead and chromium are present in some of the subsurface material at concentrations similar to those in some listed hazardous wastes, for which treatment is required prior to land disposal pursuant to 40 CFR 268 (see Table 9).

For these reasons, an alternative that combines a source treatment measure with a ground water treatment measure is needed. S/S would address all risks due to the source if it is successful. The effectiveness of S/S at Midco II would be evaluated by treatability tests prior to its implementation.

Compared to S/S, incineration followed by S/S would more reliably treat the organic compounds. However, incineration is considerably more expensive than S/S by itself, and, if S/S is successful, incineration would do little to further reduce risks.

Vitrification, if it worked, would more reliably address both the organic and inorganic contaminants. It also treats both organic and inorganic compounds in one operation, which is an advantage. However, there is a large degree of uncertainty about whether vitrification is practical at this site because of the high water table. In addition, it is estimated to be considerably more expensive than S/S and, if S/S is successful, would do little to further reduce risks.

All the ground water treatment alternatives would result in attaining ARARS and providing long-term protection of the Calumet aquifer at the site when combined with a source treatment alternative. They differ only in their method of treatment and disposal of the highly saline contaminated ground water. The treatment and deep well injection alternative (4C) may substantially reduce TMV of contaminants in the ground water prior to deep well injection.

Organic compounds would be removed by stripping and carbon absorption. If residuals from this treatment are incinerated, this would provide permanent treatment of these contaminants. If they are landfilled, the disposal may not be considered any more permanent than deep well injection without treatment. If cyanide treatment is required, a chlorination process may be used, which should permanently destroy the cyanide. Metals may be removed by precipitation. The metals sludge would be landfilled but may require solidification first. This disposal may not be considered more permanent than deep well injection without treatment.

The evaporation alternative (4E) would reduce the volume of all contaminants and the toxicity of contaminants in the blow down by incineration. However, extensive treatment of the salt cake would likely be required prior to land disposal under the RCRA Land Disposal Restrictions. If such treatment is not required, alternative 4E would include disposal of significant quantities of hazardous wastes in off-site landfills.

The deep well injection without treatment alternative (4A) would not reduce TMV of contaminants in the ground water. However, if a petition to allow land disposal is approved by U.S. EPA, this alternative should provide permanent human health and environmental protection since the petition must demonstrate that there will be no migration from the injection zone while the wastes remain hazardous. In addition, alternative 4A is considerable less expensive than alternative 4C.

X. THE SELECTED REMEDY

U.S. EPA selects either alternative 7 or 8 for implementation at Midco II. These alternatives are described in Sections XIII and IX. Alternative 7 will be implemented if a petition to allow injection of waste prohibited under 40 CFR Part 148 Subpart B is approved by U.S. EPA. In this case, the permanence of the remedial action would be considered equivalent to alternative 8, and alternative 7 is less expensive. If a petition is not approved, alternative 8 will be implemented.

The selected alternative will also include site access restrictions and imposition of deed restrictions, as appropriate. Either alternative will include treatment of the source by S/S. This is the least expensive alternative that will permanently reduce TMV of the source and be fully protective of human health and the environment. However, implementation of this source remedial action depends on the results of the treatability tests for S/S. If the treatability tests show that S/S will not provide a significant reduction in mobility of the hazardous substances of concern, the ROD will be reopened and a different source control measure will be selected. A more detailed cost breakdown for these alternatives is in Tables 15 and 16 in the Appendix.

Clean Up Action Levels (CALs):

Soil Clean Up Action Levels:

All subsurface materials affected by the site or by Midco operations that exceed any of the following risk based levels will be treated:

Cumulative Lifetime Carcinogenic Risk = 1×10^{-5}
Cumulative Chronic Noncarcinogenic Index = 1.0
Subchronic Risk Index = 1.0

Ground Water Clean Up Action Levels:

All portions of the Calumet aquifer affected by the site or by Midco operations that exceed any of following risk-based levels will be recovered and treated (except as provided for in the subsequent discussion). The ground water pumping, treatment and disposal system shall continue to operate until the hazardous substances in all portions of the Calumet aquifer affected by the site or by Midco operations are reduced below each of these risk-based levels (except as provided for in the subsequent discussion). Applying the CALs throughout the contaminated plume is consistent with F.R., Vol. 53, No 245, p. 51426.

Cumulative Lifetime Carcinogenic Risk = 1×10^{-5}
Cumulative Noncarcinogenic Index = 1.0
Subchronic Risk = 1.0
Primary MCLs (40 CFR 141)
Chronic AWQC for protection of aquatic life multiplied by a factor 3.6

Evaluation of Attainment of CALs:

The risk levels will be calculated from the soil and ground water analytical results using the assumptions listed in Tables 2, 3, 4 and 5 in the Appendix (except that in place of the average site concentration, actual measured soil and ground water concentrations in each sample location will be used, and soil ingestion rates for chronic exposures of 0.2 gram per day for ages 1-6 and 0.1 gram per day for older age groups will be used), the procedures in the Superfund Public Health Evaluation Manual and U.S. EPA's most recently published carcinogenic potency factors and reference doses.

For inorganic compounds in ground water, the analytical results from filtered samples will be used. The analytical procedures will at least reach the analytical detection limits listed in Tables 17 and 18 in the Appendix. Constituents that are not detected shall not be included in risk calculations. Constituents that are detected below background concentrations identified in Tables 17 and 18 shall not be included in the risk calculations.

If only one constituent is detected in ground water at a concentration that is calculated to potentially cause a lifetime, incremental carcinogenic risk of 1×10^{-5} or greater, and an MCL has been promulgated for this constituent pursuant to 40 CFR 141, then the MCL will be the CAL for that constituent. In addition, that constituent will not be used in the cumulative risk calculation.

JUSTIFICATION FOR USE OF 10^{-5} RISK LEVEL:

Use of the 1 X 10^{-5} lifetime, cumulative carcinogenic risk level as opposed to the 1 X 10^{-6} level is considered more appropriate for a soil CAL for this site because residential development is unlikely because of the industrial usage of the area.

Use of the 1 X 10^{-5} lifetime, cumulative carcinogenic risk level is considered more appropriate for the ground water CAL as opposed to the 1 X 10^{-6} level because the Calumet aquifer is little used in the vicinity of the Site, and because there are multiple contaminant sources that are affecting the Calumet aquifer in the vicinity of the Site. In addition, the 10^{-6} level is generally well below the analytical detection limits for the constituents of concern.

CRITERIA FOR CONTROL OF AIR EMISSIONS:

Each separate source of air emissions shall be controlled to prevent exposures to the nearest resident and workers on adjacent properties from causing an estimated cumulative, incremental, lifetime carcinogenic risk exceeding 1 x 10^{-7}. Since there are multiple operations that cause air emissions, each must be controlled to the 1 x 10^{-7} carcinogenic risk level to assure that the total risk will be less than 1 x 10^{-6}. The following operations will be considered separate sources:

1. Subsurface soil excavation and handling;.
2. Emissions from S/S;
3. Emissions from ground water treatment.

The risk levels will be calculated using conservative assumptions, the procedures in the U.S. EPA Public Health Evaluation Manual and Exposure Assessment Manual, and the most recent U.S. EPA published carcinogenic potency factor. The emissions must also be controlled to prevent any non-carcinogenic risk either on-site or off-site. Fugitive dust must be controlled in compliance with State of Indiana requirements.

The selected remedial actions will be protective of human health and the environment, will attain applicable or relevant and appropriate Federal and State requirements and are cost effective. The remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility or volume as a principal element and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

The State of Indiana is expected to concur with the selected remedial actions. Although there is some public concern about the deep well injection operation, it is believed that the protective measures required in U.S. EPA's Underground Injection Control Program coupled with source (soil) treatment provide a more acceptable technology for the community than the further degradation of the existing Calumet aquifer or the Grand Calumet River.

Because the remedy will result in hazardous substances remaining on-site above health-based levels, a review will be conducted within five years after commencement of remedial actions to ensure that the remedy continues to provide adequate protection of human health and the environment.

– APPENDIX TO MIDCO II RECORD OF DECISION

Table 1: Concentrations in Various Environmental Media

Table 2: Standard Parameters Used for Dosage

Table 3: Potential Exposure Pathways for the Midco II Site

Table 4: Routes of Exposures Used in Calculation of Intakes

Table 5: Characteristics of Subchronic/Chronic Exposure Scenarios

Table 6: Midco II Location Specific Requirements

Table 7: Midco II Action Specific Requirements

Table 8: Alternative's Compliance with Applicable Laws and Regulations

Table 9: Comparison of Concentrations of Inorganics in Subsurface Material at Midco II with Concentrations in Listed Hazardous Wastes

Table 10: Effectiveness Evaluation of Alternatives

Table 11: Implementability Evaluation at Alternatives

Table 12: Detailed Analysis Summary

Table 13: Midco II Estimated Costs in Millions of Dollars and Time to Implement

Table 14: Midco II Table of Effectiveness and Implementability

Table 15: Alternative 7 ... Cost Estimate

Table 16: Alternative 8 ... Cost Estimate

Table 17: Ground Water Cleanup Action Levels

Table 18: Soil Cleanup Action Levels

Table 19: Land Disposal Restriction Treatment Standards for Waste Categories F001, F002, F003, F005 (from 40 CFR 268.41)

Table 20: Proposed Land Disposal Restriction Treatment Standards for Waste Categories F007, F008, F009 (from F.R., Vol. 53, No. 7, p. 1068)

Table 21: Alternative Treatability Variance Levels and Technologies for Structural/Functional Groups

Responsiveness Summary

A Guide to the Federal Underground Injection Control Program in Indiana

Waste Treatment Results for Inorganics

Table 1

WORKSHEET 1.
SCORING FOR INDICATOR CHEMICAL SELECTION:
CONCENTRATIONS AND Koc VALUES IN VARIOUS ENVIRONMENTAL MEDIA

NAME OF SITE: MIDCO II
DATE: 26 January 1988
ANALYST: LB
QC: SCL

CHEMICAL	Koc	PHASE 1 GROUND WATER (mg/L)			PHASE 2 GROUND WATER (mg/L)			SURFACE WATER PHASE 1 (mg/L)			SURFACE WATER PHASE 2 (mg/L)		
		MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN
Aluminum U		ND	5.51E+01	5.81E+00	3.00E-02	4.80E-01	1.82E-01	1.81E-01	1.95E+01	3.56E+00	9.84E-02	2.69E-01	1.68E-01
Arsenic		ND	1.78E-01	3.40E-02	ND	1.14E+00	1.87E-01	2.87E-03	2.21E-02	9.47E-03	2.87E-03	5.82E-02	3.06E-02
Barium		ND	1.14E+00	3.75E-01	7.90E-03	1.42E+00	3.08E-01	7.39E-02	4.80E-01	1.47E-01	6.52E-02	1.80E-01	1.07E-01
Beryllium					ND	1.30E-02	7.92E-04	ND	ND	ND	ND	4.64E-03	3.92-04
Cadmium		ND	1.40E-02	2.37E-03	ND	2.70E-02	8.07E-03	ND	4.91E-03	1.09E-03	ND	1.03E-02	3.55E-03
Calcium U		7.20E-01	8.14E+02	1.52E+02	9.16E+00	8.54E+02	1.21E+02	8.76E+01	3.76E+02	1.64E+02	9.44E+01	2.84E+02	1.45E+02
Chromium		ND	1.12E+00	1.00E-01	ND	9.00E-02	1.59E-02	ND	3.97E-01	5.58E-02	ND	2.13E-02	5.69E-03
Cobalt U		ND	5.00E-02	2.17E-03	ND	8.70E-02	9.73E-03	ND	1.76E-02	1.25E-03	ND	1.24E-02	3.41E-03
Copper		ND	6.06E+00	4.29E-01	6.00E-03	1.61E+00	4.45E-01	1.65E-02	2.14E+00	2.63E-01	1.64E-02	6.05E-01	2.54E-01
Iron U		1.30E-01	8.22E+01	1.37E+01	1.70E-02	3.65E+01	2.66E+00	2.83+00	3.22E+01	1.03+01	2.78E+00	1.57E+01	4.22E+00
Lead		ND	2.63E-01	7.48E-02	3.80E-03	1.64E-01	8.22E-02	6.99E-03	9.38E-02	3.92E-02	2.63E-03	8.40E-03	5.00E-03
Magnesium U		7.00E-01	6.64E+02	1.16E+02	4.21E+00	3.76E+02	9.31E+01	3.11E+01	2.59E+02	8.43E+01	2.86E+01	1.66E+02	6.56E+01
Manganese U		ND	8.33E+00	8.87E-01	8.10E-03	1.27E+01	1.07E+00	1.79E-01	3.07E+00	6.40E-01	1.62E-01	4.61E+00	7.66E-01
Mercury		ND	2.81E-03	6.12E-04	ND	3.80E-04	4.92E-05	ND	1.04E-03	2.59E-04	1.33E-04	1.33E-04	1.33E-04
Nickel		ND	1.66E+01	9.23E-01	ND	1.55E+00	2.31E-01	ND	1.28E+00	1.81E-01	4.72E-03	5.90E-01	9.99E-02
Potassium U		4.60E+00	2.12E+04	6.14E+03	3.80E+00	1.71E+04	4.62E+03	2.52E+02	2.30E+03	7.98E+02	9.86E+01	1.74E+03	6.76E+02
Selenium		ND	2.12E-01	7.40E-02	ND	1.30E+00	4.38E-01	4.29E-04	1.56E-02	7.17E-03	5.31E-02	5.31E-02	5.31E-02
Silver		ND	2.00E-02	1.25E-02	ND	9.00E-02	8.33E-03	7.02E-03	7.80E-03	7.41E-03	ND	5.85E-03	9.92E-04
Sodium U		8.10E+00	1.55E+04	4.70E+03	5.67E+00	1.64E+04	4.06E+03	1.86E+02	1.25E+03	6.26E+02	1.16E+02	1.31E+03	5.70E+02
Thallium U		ND	7.60E-02	1.78E-02	ND	1.72E-01	1.57E-02	ND	2.98E-03	1.48E-03	5.46E-04	7.45E-03	3.70E-03
Tin U		ND	1.10E+01	8.74E-01				ND	6.17E-01	1.06E-01	ND	ND	ND
Vanadium		ND	9.00E-02	1.04E-02	ND	4.80E-02	1.14E-02	ND	3.16E-02	6.02E-03	3.90E-05	1.74E-02	4.15E-03
Zinc		ND	2.10E+00	4.21E-01	3.50E-02	7.10E-01	1.74E-01	3.64E-02	4.73E-01	1.78E-01	3.64E-02	2.73E-01	1.55E-01
Cyanide U		ND	7.83E+00	4.31E-01	ND	4.66E+00	2.39E-01	1.87E-02	2.76E+00	3.37E-01	1.31E-02	1.66E+00	1.56E-01
Acenaphthene U	4.60E+03	ND	4.40E-03	1.91E-04	ND	ND	ND	ND	1.54E-03	1.10E-04	ND	ND	ND
Acetone	2.20E+00	ND	3.10E+01	2.86E+00	ND	1.10E+01	2.75E-01	ND	1.11E+01	1.62E+00	ND	1.69E+01	1.43E+00
Anthracene U	1.40E+04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	8.30E+01	ND	7.60E-02	6.00E-03	ND	9.50E-02	1.02E-02	ND	2.79E-02	2.94E-03	ND	3.47E-02	6.21E-03
Benzo(a)anthracene	1.38E+06				ND	ND	ND						
Benzo(a)pyrene	5.50E+06												
Benzo(b &k)fluoranthene U	5.50E+05												
Benzoic acid U		ND	2.80E+00	1.55E-01	ND	6.00E-01	7.24E-02	ND	7.45E-02	6.24E-03	ND	2.30E-01	2.52E-02
Bis(2-ethylhexyl)phthalate	2.00E+09	ND	1.10E-01	8.12E-03	ND	3.30E-02	3.73E-03	ND	1.06E-03	1.96E-04	ND	1.20E-02	1.30E-03
2-Butanone (MEK)		ND	2.80E+01	3.30E+00	ND	4.80E+00	3.93E-01	4.29E-04	9.84E+00	2.72E+00	ND	1.59E+00	3.53E-01
Carbon disulfide	5.40E+01												
Chloroethane U	3.00E+01	ND	3.80E-03	1.56E-04				ND	1.33E-03	9.53E-06	ND	ND	ND
Chloroform	3.10E+01												
Chrysene U	2.00E+05												
Cresol	5.00E+02	ND	5.90E-01	7.15E-02	ND	1.84E+00	1.18E-01	ND	2.09E-01	4.00E-02	ND	6.47E-01	6.74E-02
Dibenzofuran U													
Di-n-butyl phthalate	1.70E+05	ND	2.40E-03	1.91E-04	ND	3.40E-01	1.54E-02	ND	9.20E-04	6.80E-05	ND	1.19E-01	9.06E-03
1,1-Dichloroethane	3.00E+01	ND	3.00E-01	1.55E-02	ND	5.60E-01	4.39E-02	ND	1.05E-01	9.33E-03	ND	1.97E-01	2.53E-02
1,1-Dichloroethene	6.50E+01	ND	8.20E-03	3.42E-04				ND	2.86E-03	2.06E-04	ND	ND	ND
Trans-1,2-dichloroethene	5.90E+01	ND	4.80E+00	2.59E-01	ND	7.00E-01	5.75E-02	ND	1.68E+00	1.56E-01	ND	2.46E-01	3.46E-02
2,4-Dichlorophenol	3.80E+02				ND	6.20E-03	2.58E-04	ND	ND	ND	ND	2.18E-03	1.55E-04
1,2-Dichloropropane	5.10E+01	ND	7.30E-02	3.04E-03	ND	1.00E-01	4.17E-03	ND	2.56E-02	1.83E-03	ND	3.51E-02	2.51E-03
Diethyl phthalate	1.42E+02	ND	2.40E-02	1.31E-03	ND	1.90E-02	1.63E-03	ND	8.56E-03	6.26E-04	ND	6.34E-03	5.76E-04
2,4-Dimethylphenol U	9.60E+01	ND	1.80E-01	1.31E-02	ND	6.00E-01	3.17E-02	ND	6.33E-02	7.49E-03	ND	2.11E-01	1.90E-02
Dioctyl phthalate	3.60E+09							ND	ND	ND	ND	3.51E-03	2.51E-04
Ethylbenzene	1.10E+03	ND	8.40E+00	7.13E-01	ND	2.20E+01	1.28E+00	ND	2.95E+00	4.26E-01	ND	7.72E+00	7.70E-01
Fluoranthene U	3.80E+04												
Fluorene U	7.30E+03	ND	4.40E-03	1.91E-04	ND	1.40E-02	7.00E-04	ND	1.54E-03	1.10E-04	ND	4.91E-03	4.21E-04
Isophorone U	8.70E+01	ND	2.00E+01	9.38E-01	ND	1.40E+01	6.08E-01	ND	7.02E+00	5.41E-01	ND	4.91E+00	3.66E-01
2-Methylnaphthalene U		ND	1.10E-01	1.04E-02	ND	2.10E-01	1.87E-02	ND	3.87E-02	5.95E-03	ND	7.39E-02	9.33E-03
Methylene chloride	8.80E+00	ND	2.80E+01	1.55E+00	ND			ND	9.15E+00	8.01E-01	ND	2.67E+01	2.36E+00
4-Methyl-2-pentanone U		ND	1.80E+02	7.93E+00	ND	4.60E+02	2.08E+01	ND	6.63E+01	4.69E+00	ND	1.62E+02	1.24E+01
Naphthalene U		ND	2.40E-01	2.09E-02	ND	6.90E-02	1.35E-02	ND	6.44E-02	1.20E-02	ND	3.14E-02	8.01E-03
N-Nitrosodiphenylamine U													
4,4'-DDE	4.40E+06												
PCBs													
Phenanthrene U	1.40E+04	ND	4.80E-03	3.48E-04	ND	6.00E-03	2.08E-02	ND	1.68E-03	2.01E-04	ND	1.76E-03	1.25E-04
Phenol	1.42E+01	ND	9.80E-01	5.83E-02	ND	6.60E-01	5.66E-02	ND	3.48E-01	3.12E-02	ND	2.03E-01	2.96E-02
Pyrene U	3.80E+04												
Tetrachloroethene	3.64E+02	ND	2.30E-01	9.78E-03	ND	3.10E-01	1.29E-02	ND	8.07E-02	5.89E-03	ND	1.09E-01	7.77E-03
Toluene	3.00E+02	ND	3.50E+01	2.52E+00	ND	8.40E+01	6.08E+00	ND	1.23E+01	1.51E+00	ND	2.95E+01	3.08E+00
1,1,1-Trichloroethane	1.52E+02	ND	1.00E+00	6.75E-02	ND	1.00E+00	1.73E-01	ND	3.51E-01	3.46E-02	ND	3.81E-01	3.81E-02
Trichloroethene	1.26E+02	ND	4.40E+01	1.64E+00	ND	2.40E+02	1.00E+01	ND	1.54E+01	1.11E+00	ND	8.42E+01	6.04E+00
Vinyl chloride	5.70E+01	ND	2.10E-02	8.73E-04				ND	7.37E-03	5.27E-04	ND	ND	ND
Xylene	2.40E+02	ND	2.20E+01	2.15E+00	ND	6.40E+01	3.42E+00	ND	7.72E+00	1.29E+00	ND	1.90E+01	2.05E+00
Antimony													
1,4-Dichlorobenzene	1.70E+03												
1,2-Dichlorobenzene	1.70E+03												
1,2,4-Trichlorobenzene	9.20E+03												
4-Chloroaniline U													
Acenaphthylene U	2.50E+03												
Indeno(1,2,3-cd)pyrene U	1.60E+06												
Dibenzo(a,h)anthracene	3.30E+06												
Benzo(ghi)perylene U	1.60E+06												
1,1,2,2-Tetrachloroethane	1.18E+02												
1,1,2-Trichloroethane	5.60E+01												
4-Nitroaniline U		ND	2.20E-03	9.57E-05				ND	8.54E-05	8.56E-06	ND	ND	ND
Chlordane	1.40E+05												
Butyl benzyl phthalate U	1.70E+05												
Chlorobenzene	3.30E+02												
Carbon tetrachloride	1.10E+02												
Benzidine	1.05E+01												
2,4-Dinitrotoluene	4.50E+01	ND	2.80E-03	2.17E-04				ND	8.81E-04	8.81E-05	ND	ND	ND
4-Nitrophenol U	4.50E+01	ND	5.20E-03	2.29E-04				ND	2.03E-04	2.03E-05	ND	ND	ND
Bis(2-chloroethoxy)methane U		ND	8.60E-03	3.83E-04				ND	3.09E-03	2.21E-04	ND	ND	ND
Bis(2-chloroethyl)ether	1.39E+01	ND	1.00E-02	4.35E-04	ND	1.10E-02	4.58E-04	ND	3.51E-03	2.51E-04	ND	3.86E-03	2.76E-04
Bis(2-chloroisopropyl)ether								ND	9.36E-05	9.36E-06	ND	ND	ND
Heptachlor Epoxide								ND	ND	ND	ND	7.72E-05	5.52E-06

U = UNKNOWN, NO TOXICITY CONSTANTS FOR THE ENVIRONMENTAL MEDIA AVAILABLE
U* = REFERENCE DOSE AVAILABLE, THEREFORE, CONSIDERED IN THE FINAL IS VALUES

WORKSHEET 1. CONTINUED

NAME OF SITE: MIDCO II
DATE: 26 January 1988
ANALYST: LB
QC: SCL

CHEMICAL	SOILS (mg/kg)			SEDIMENTS PHASE 1 (mg/kg)			SEDIMENTS PHASE 2 (mg/kg)			TRENCHES (mg/kg)		
	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN
Aluminum U	9.09E+02	2.12E+05	4.28E+04	9.04E+02	1.93E+04	9.25E+03	6.56E+03	2.13E+04	1.29E+04	5.21E+04	1.66E+05	5.21E+04
Arsenic	2.30E+00	8.40E+01	1.84E+01	2.20E+00	2.72E+02	6.40E+01	1.60E+01	3.20E+01	2.53E+01	ND	1.43E+03	1.11E+02
Barium	3.50E+00	3.34E+02	8.66E+01	7.10E+00	4.82E+00	1.33E+02	1.47E+02	5.95E+02	3.71E+02	ND	1.56E+03	1.89E+02
Beryllium	ND	9.60E+00	2.01E+00				ND	2.30E+00	9.70E-01	ND	1.80E+01	2.93E+00
Cadmium	2.40E-01	9.10E+00	3.49E+00	1.90E+00	8.40E+00	4.35E+00	6.30E+00	1.40E+01	1.06E+01	ND	2.60E+01	4.63E+00
Calcium U	1.58E+04	1.23E+05	5.37E+04	1.72E+04	1.40E+05	4.63E+04	3.14E+04	8.77E+04	6.71E+04	5.70E+03	6.91E+04	2.72E+04
Chromium	1.80E+00	1.06E+03	1.79E+02	2.40E+00	6.12E+02	1.82E+02	1.83E+02	7.63E+02	4.28E+02	ND	1.96E+03	2.71E+02
Cobalt U	ND	8.00E+00	1.40E+00	ND	1.20E+01	4.77E+00	2.00E+01	6.10E+01	4.00E+01	ND	2.40E+01	3.28E+00
Copper	9.60E+00	2.48E+03	6.25E+02	9.40E+00	1.39E+04	2.50E+03	1.18E+03	8.71E+03	3.60E+03	2.90E+00	4.76E+03	1.61E+03
Iron U	3.41E+03	4.39E+04	1.66E+04	4.07E+03	1.19E+05	3.23E+04	9.63E+03	8.59E+04	4.28E+04	2.07E+03	3.19E+04	1.20E+04
Lead	3.60E+00	4.57E+02	1.61E+02	4.90E+00	9.82E+02	4.29E+02	3.87E+02	1.29E+03	8.07E+02	2.50E+00	2.81E+03	4.29E+02
Magnesium U	7.23E+03	6.75E+04	2.66E+04	3.83E+03	1.20E+04	8.96E+03	4.96E+03	1.19E+04	8.42E+03	3.40E+03	3.88E+04	1.73E+04
Manganese U	1.47E+02	3.95E+03	1.04E+03	1.01E+02	1.38E+03	4.10E+02	2.64E+02	6.94E+02	5.19E+02	6.00E+01	1.92E+03	6.04E+02
Mercury	ND	2.50E-01	7.43E-02	ND	5.00E-01	2.14E-01				ND	1.80E+00	1.56E-01
Nickel	ND	1.66E+02	5.29E+01	ND	9.18E+02	1.78E+02	6.50E-01	3.18E+02	1.71E+02	ND	1.43E+03	1.46E+02
Potassium U	2.85E+02	1.38E+03	6.67E+02	2.59E+02	1.33E+04	2.96E+03	1.51E+03	9.66E+03	4.94E+03	2.15E+02	4.79E+03	8.89E+02
Selenium	ND	2.50E+00	7.58E-01	9.10E-01	4.50E+00	3.17E+00				ND	3.30E+00	1.56E+00
Silver	ND	6.40E+00	2.13E+00	1.40E+00	1.70E+00	1.60E+00	1.40E+01	1.40E+01	1.40E+01	1.50E+00	6.10E+00	2.78E+00
Sodium U	3.11E+02	1.84E+03	7.44E+02	2.12E+02	1.07E+04	2.63E+03	1.12E+03	9.94E+03	4.51E+03	1.59E+02	3.83E+03	8.72E+02
Thallium U	ND	1.10E+00	1.57E-01									
Tin U	2.10E+00	1.30E+02	2.42E+01	7.30E+00	4.30E+01	2.29E+01				ND	1.29E+02	2.15E+01
Vanadium	4.40E+00	9.40E+01	4.02E+01	3.50E+00	1.24E+02	3.82E+01	2.20E+00	3.70E+01	2.28E+01	ND	4.90E+02	7.73E+01
Zinc	1.30E+01	2.87E+03	6.95E+02	3.50E+01	2.86E+03	6.53E+02	6.64E+02	1.41E+03	1.06E+03	1.90E+00	4.65E+03	1.06E+03
Cyanide U	ND	4.40E+01	8.14E+00	ND	7.62E+02	1.63E+02	ND	1.51E+02	7.13E+01	ND	1.34E+02	1.51E+01
Acenaphthene U	ND	3.20E-01	4.57E-02				ND	1.60E+01	4.00E+00	ND	6.40E+00	6.62E-01
Acetone	6.60E-02	1.10E+01	5.53E+00	ND	1.40E+00	3.79E-01	ND	2.70E+01	2.48E+01	ND	6.10E+01	5.18E+00
Anthracene U	ND	7.90E-01	1.22E-01	ND	1.40E+01	2.00E+00	ND	6.40E+00	1.38E+00	ND	1.60E+01	1.57E+00
Benzene	ND	3.20E-02	4.90E-03	ND	2.80E-03	4.00E-04	ND	1.10E-02	2.75E-03	ND	2.10E-02	1.33E-03
Benzo(a)anthracene	ND	1.60E+00	6.63E-01	ND	3.30E+00	4.91E-01	ND	1.80E+01	4.50E+00	ND	3.10E+00	5.19E-01
Benzo(a)pyrene	ND	1.20E+00	4.47E-01				ND	1.10E+01	2.75E+00	ND	2.80E+00	2.23E-01
Benzo(b &k)fluoranthene U	ND	2.40E+00	7.10E-01				ND	1.10E+01	2.75E+00	ND	4.50E+00	2.40E-01
Benzoic acid U												
Bis(2-ethylhexyl)phthalate	ND	9.80E+00	1.65E+00	ND	4.40E+02	9.84E+01	1.90E+01	6.60E+02	2.32E+02	ND	2.60E+02	1.63E+01
2-Butanone (MEK)	ND	9.30E-03	2.33E-03	2.60E-02	3.00E-01	1.63E-01	ND	6.60E+01	2.83E+01	ND	1.60E+01	5.90E+00
Carbon disulfide	ND	2.10E-01	3.13E-02	ND	2.30E-02	3.29E-03				ND	4.60E-03	1.53E-04
Chloroethane U												
Chloroform	ND	2.60E-01	3.93E-02	ND	4.20E-02	6.00E-03				ND	3.40E-03	1.63E-04
Chrysene U	ND	1.60E+00	6.07E-01	ND	1.60E+01	2.79E+00	ND	3.70E+01	9.25E+00	ND	3.80E+00	7.42E-01
Cresol	ND	ND	ND	ND	9.10E-02	1.30E-02				ND	1.99E+00	6.63E-02
Dibenzofuran U	ND	2.50E-01	6.57E-02							ND	5.30E+00	3.23E+02
Di-n-butyl phthalate	ND	1.50E+00	2.38E-01	ND	2.40E+02	6.51E+01	ND	6.10E+02	1.57E+02	ND	1.00E+01	1.38E+00
1,1-Dichloroethane												
1,1-Dichloroethene												
Trans-1,2-dichloroethene	ND	2.10E-03	3.00E-04							ND	8.20E-03	3.63E-04
2,4-Dichlorophenol										ND	2.70E+01	9.00E-01
1,2-Dichloropropene	ND	2.20E-03	3.14E-04							ND	4.90E-01	4.22E+01
Diethyl phthalate										ND	1.80E-01	6.00E-03
2,4-Dimethylphenol U										ND	7.70E+00	3.46E-01
Dioctyl phthalate	ND	4.50E+00	6.57E-01	ND	1.80E+02	3.88E+01	ND	2.70E+02	8.60E+01	ND	2.40E+01	2.48E+00
Ethylbenzene	ND	1.90E+02	2.71E+01	ND	6.50E+02	1.53E+02	ND	3.10E+02	1.08E+02	ND	7.80E+02	6.82E+01
Fluoranthene U	ND	8.70E+00	1.01E+00	ND	2.20E-01	4.71E-02	ND	6.00E+00	2.25E+00	ND	6.90E+00	7.81E-01
Fluorene U	ND	3.70E-02	6.40E-02				ND	1.80E+01	4.50E+00	ND	1.10E+01	1.66E+00
Isophorone U	ND	1.00E+01	1.43E+00							ND	2.90E+01	3.00E+00
2-Methylnaphthalene U	ND	2.00E+00	5.24E-01	ND	4.90E+01	9.43E+00	ND	8.40E+01	2.95E+01	ND	9.60E+01	1.66E+01
Methylene chloride	ND	2.10E-01	8.57E-02	ND	1.60E+01	1.18E+01	ND	3.60E+00	1.05E+00	ND	2.30E+01	1.89E+00
4-Methyl-2-pentanone U	ND	1.00E-01	1.43E-02							ND	2.70E+01	9.38E-01
Naphthalene U	ND	7.00E+00	1.10E+00	ND	6.20E+01	1.31E+01	ND	4.80E+01	1.85E+01	ND	4.70E+01	5.71E+00
N-Nitrosodiphenylamine U	ND	6.00E-01	8.57E-02	ND	2.00E+02	7.48E+01	ND	3.90E+02	1.19E+02	ND	4.40E+00	2.09E-01
4,4'-DDE										ND	2.90E-02	6.67E-04
PCBs	ND	3.00E+01	4.29E+00	ND	9.20E+00	1.31E+00	ND	3.40E+01	8.66E+00	ND	4.10E+01	8.12E+00
Phenanthrene U	ND	3.80E+00	7.50E-01	ND	2.90E+01	6.04E+00	ND	7.00E+01	1.84E+01	ND	2.00E+01	5.04E+00
Phenol										ND	3.40E+00	1.57E-01
Pyrene U	ND	2.60E+00	7.11E-01	ND	2.10E+01	3.08E+00	ND	5.30E+01	1.33E+01	ND	6.00E+00	1.45E+00
Tetrachloroethene	ND	3.40E+00	4.86E-01							ND	1.80E+01	1.34E+00
Toluene	ND	1.80E+02	2.57E+01	ND	1.70E+02	3.19E+01	ND	6.80E+01	2.50E+01	ND	1.10E+03	7.10E+01
1,1,1-Trichloroethane	ND	ND	ND							ND	1.40E+01	5.64E-01
Trichloroethene	ND	3.40E+00	4.83E-01							ND	3.30E+01	1.46E+00
Vinyl chloride												
Xylene	ND	6.30E+02	7.57E+01	ND	1.80E+03	8.18E+02	ND	1.10E+03	3.83E+02	ND	1.80E+03	1.99E+02
Antimony	1.60E+00	1.30E+01	4.33E+00	1.30E+00	1.63E+02	3.70E+01				ND	1.58E-01	1.74E-02
1,4-Dichlorobenzene										ND	1.60E+00	5.67E-02
1,2-Dichlorobenzene										ND	5.80E+00	1.83E-01
1,2,4-Trichlorobenzene										ND	1.10E+00	3.67E-02
4-Chloroaniline U										ND	5.40E+01	1.80E+00
Acenaphthylene U	ND	3.20E-01	4.57E-02							ND	1.40E+00	4.67E-02
Indeno(1,2,3-cd)pyrene U	ND	6.60E-01	1.67E-01							ND	2.10E-01	1.52E-02
Dibenzo(a,h)anthracene	ND	2.20E-01	3.14E-02							ND	1.50E-01	7.00E-03
Benzo(ghi)perylene U	ND	6.90E-01	2.30E-01							ND	3.20E-01	2.77E-02
1,1,2,2-Tetrachloroethane										ND	3.20E-03	1.07E-04
1,1,2-Trichloroethane										ND	1.70E+00	6.15E-02
4-Nitroaniline U												
Chlordane	ND	1.00E-01	1.43E-02	ND	9.50E+00	1.49E+00	ND	1.60E+01	8.75E+00	ND	3.90E-01	1.30E-02
Butyl benzyl phthalate U	ND	8.40E-01	1.20E-01	ND	6.80E+01	2.00E+01	ND	5.20E+01	2.20E+01	ND	1.50E+01	9.43E-01
Chlorobenzene										ND	3.00E-02	1.00E-03
Carbon tetrachloride	ND	3.40E-02	5.40E-03									
Benzidine												
2,4-Dinitrotoluene												
4-Nitrophenol U												
Bis(2-chloroethoxy)methane U												
Bis(2-chloroethyl)ether												
Bis(2-chloroisopropyl)ether												
Heptachlor Epoxide												

U = UNKNOWN, NO TOXICITY CONSTANTS FOR THE ENVIRONMENTAL MEDIA AVAILABLE
U* = REFERENCE DOSE AVAILABLE, THEREFORE, CONSIDERED IN THE FINAL IS VALUES

NAME OF SITE: MIDCO II
DATE: 28 January 1988
ANALYST: SCL
QC:

WORKSHEET 1. CONTINUED

CHEMICAL	PHASE 3 GROUND WATER (mg/L) MIN	MAX	MEAN	PHASE 3 SEDIMENTS** (mg/kg) MIN	MAX	MEAN
Aluminum U	ND	3.70E-02	1.36E-02	9.94E+03	8.06E+04	2.98E+04
Arsenic	1.40E-02	2.44E-01	6.81E-02	1.70E+00	6.40E+01	2.59E+01
Barium	6.80E-02	4.44E+00	1.48E+00	1.10E+01	2.35E+02	1.12E+02
Beryllium				ND	8.10E-01	2.86E-01
Cadmium				ND	4.90E+00	1.63E+00
Calcium U	1.28E+02	1.69E+03	8.24E+02	2.70E+04	8.41E+04	4.14E+04
Chromium				2.60E+00	1.70E+02	6.95E+01
Cobalt U	6.40E-03	2.30E-02	1.23E-02	3.80E+00	7.10E+00	5.40E+00
Copper	4.60E-03	2.70E-02	9.75E-03	7.00E+01	2.07E+03	7.74E+02
Iron U	7.79E-01	2.72E+02	4.43E+01	3.06E+03	4.65E+04	2.16E+04
Lead	ND	2.20E-02	2.75E-03	1.70E+01	4.02E+02	1.73E+02
Magnesium U	1.54E+01	3.86E+02	1.35E+02	1.20E+04	1.40E+04	1.33E+04
Manganese U	9.40E-02	2.81E+00	7.95E-01	1.74E+02	1.20E+03	6.24E+02
Mercury	ND	2.00E-04	2.50E-05	ND	1.10E+00	6.30E-01
Nickel				ND	1.02E+02	3.07E-01
Potassium U	ND	1.83E+03	4.38E+02	ND	2.64E+03	8.87E+02
Selenium	ND	1.30E-02	1.50E-02			
Silver	ND	7.90E-03	9.88E-04			
Sodium U	9.41E+00	3.63E+03	8.90E+02	ND	2.16E+03	7.20E+02
Thallium U	ND	1.10E-02	1.75E-03			
Tin U						
Vanadium	ND	5.00E-02	1.79E-02	6.40E+00	1.76E+02	6.65E+01
Zinc	6.10E-02	8.53E-01	2.22E-01	1.00E+02	2.07E+03	6.33E+02
Cyanide U	ND	3.20E-02	7.88E-03	ND	3.40E+00	1.50E+00
Acenaphthene U						
Acetone	ND	0.00E+00	0.00E+00			
Anthracene U				ND	8.80E-01	2.93E-01
Benzene						
Benzo(a)anthracene				ND	1.90E-01	9.67E-02
Benzo(a)pyrene				ND	1.80E-01	9.67E-02
Benzo(b&k)fluoranthene U				ND	5.10E-01	2.60E-01
Benzoic acid U						
Bis(2-ethylhexyl)phthalate				8.70E-02	4.20E-01	2.86E-02
2-Butanone (MEK)	ND	0.00E+00	0.00E+00	ND	9.00E-03	3.00E-03
Carbon disulfide						
Chloroethane U						
Chloroform						
Chrysene U				ND	3.00E-01	1.60E-01
Cresol						
Dibenzofuran U						
Di-n-butyl phthalate				ND	6.80E-01	2.93E-01
1,1-Dichloroethane						
1,1-Dichloroethene						
Trans-1,2-dichloroethene						
2,4-Dichlorophenol						
1,2-Dichloropropane						
Diethyl phthalate						
2,4-Dimethylphenol U						
Dioctyl phthalate						
Ethylbenzene						
Fluoranthene U				ND	4.10E-01	2.17E-01
Fluorene U						
Isophorone U						
2-Methylnaphthalene U				ND	5.70E-02	1.90E-02
Methylene chloride	ND	0.00E+00	0.00E+00			
4-Methyl-2-pentanone U						
Naphthalene U				ND	9.70E-02	6.43E-02
N-nitrosodiphenylamine U						
4,4'-DDE						
PCBs						
Phenanthrene U				ND	2.00E-01	1.27E-01
Phenol						
Pyrene U				7.60E-02	3.90E-01	2.42E-01
Tetrachloroethene						
Toluene						
1,1,1-Trichloroethane						
Trichloroethene						
Vinyl chloride						
Xylene						
Antimony						
1,4-Dichlorobenzene						
1,2-Dichlorobenzene						
1,2,4-Trichlorobenzene						
4-Chloroaniline U						
Acenaphthylene U						
Indeno(1,2,3-cd)pyrene U						
Dibenz(a,h)anthracene						
Benzo(g,h,i)perylene U						
1,1,2,2-Tetrachloroethane						
1,1,2-Trichloroethane						
4-Nitroaniline U						
Chlordane						
Butyl benzyl phthalate U						
Chlorobenzene						
Carbon tetrachloride						
Benzidine						
2,4-Dinitrotoluene						
4-Nitrophenol U						
Bis(2-chloroethoxy)methane U						
Bis(2-chloroethyl)ether						
Bis(2-chloroisopropyl)ether						
Heptachlor epoxide						

**These sediment results are considered background and were not used in selection of indicator compounds.
U = UNKNOWN, NO TOXICITY CONSTANTS FOR THE ENVIRONMENTAL MEDIA AVAILABLE
U* = REFERENCE DOSE AVAILABLE, THEREFORE, CONSIDERED IN THE FINAL IS VALUES

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Table 2

TABLE 6-1
Standard Parameters Used for Calculation of Dosage and Intake

Parameter	Adult	Child age 6-12	Child age 2-6
Physical Characteristics			
Average Body Weight	70 kg (1,2)	29 kg (3)	16 kg (3)
Average Surface Area	18150 cm2 (1)	10470 cm2 (3)	6980 cm2(3)
Activity Characteristics			
Amount of Water Ingested Daily	2 liters (1)	1 liter (2)	1 liter (2)
Amount of Air Breathed Daily	20 m3 (1)	11 m3 (1)	6 m3 (1)
Amount of Fish Consumed Daily	6.5 g (1)		
Soil Ingested (Pica) Daily			1.0 g (1)
Frequency of Water Use for Swimming	7 days/yr (1)	7 days/yr (1)	
Duration of Exposure While Swimming	2.6 hrs/day (1)	2.6 hrs/day (1)	
Percentage of Surface Area Immersed While Bathing	0.8 (4)	0.8 (4)	0.8 (4)
Length of Exposure While Bathing	20 min (5)	20 min (5)	20 min (5)
Length of Additional Exposure After Bathing	10 min (5)	10 min (5)	10 min (5)
Amount of Air Breathed While Bathing	.55 m3 (1),(5)	.60 m3 (1),(5)	.49 m3 (1),(5)
Volume of Showerstall	3 m3 (5)	3 m3 (5)	3 m3 (5)
Volume of Bathroom	10 m3 (5)	10 m3 (5)	10 m3 (5)
Volume of Water Used While Showering	200 liters(5)	200 liters(5)	200 liters(5)
Material Characteristics			
Dust Adherence	0.51 mg/cm3 (6)		
Transfer Ratio of Contaminant From Water to Air	1/10000 (4)		
Mass Flux Rate (water-based)	0.2-0.5 mg/cm2/hr (1)		

(1) U.S. EPA, 1986a
(2) U.S. EPA, October 1986
(3) U.S. EPA, 1985d
(4) U.S. EPA, 1984b
(5) Symms, 1986
(6) Lepow, 1974

Table 3

Table 6-5.
MIDCO II
Exposure Pathway Analysis
On-site Future Use Scenario

MEDIA	PATHWAY	EXPOSURE MECHANISM	TYPE OF EXPOSURE	SELECTED FOR ANALYSIS
Air	Waste Reaction	Volatilization	Dermal Contact Inhalation	No - not likely, site covered with fill with partial vegetative cover
	Contaminated fill/soil	Volatilization	Inhalation	Yes
	Contaminated fill/soil	Fugitive dust	Dermal Contact Inhalation	No - not likely, site covered with fill with partial vegetative cover
	Surface water	Volatilization	Inhalation	Yes - covered under surface water
Ground Water	Movement through aquifer - use through residential and industrial wells	Drinking water	Ingestion	Yes - local wells used
		Bathing	Dermal contact	Yes - local wells used
			Inhalation	Yes - local wells used
		Household Use	Inhalation	Yes
Soils (Sediments)	Contaminated fill/soil	Fugitive dust	Dermal contact	Yes
			Inhalation	No
			Ingestion	Yes - PICA
Surface Water	Ground water discharge to drainage ditch	Casual contact	Dermal contact	Yes
			Ingestion	No - not used for drinking water
		Volatilization	Inhalation	Yes
			Bioaccumulation	No - currently under investigation by U.S. Fish and Wildlife

Table 6-5. (Continued)
MIDCO II
Exposure Pathway Analysis
Nearest Residence Scenario

MEDIA	PATHWAY	EXPOSURE MECHANISM	TYPE OF EXPOSURE	SELECTED FOR ANALYSIS
Air	Waste Reaction	Volatilization	Dermal Contact Inhalation	No - not likely, site covered with fill with partial vegetation
	Contaminated fill/soil	Volatilization	Inhalation	Yes - probably low exposure levels
		Adsorption to dusts	Dermal Contact Inhalation	No - not likely, site covered with fill with partial vegetation
	Contaminated surface water	Volatilization	Inhalation	Yes
Ground Water	Movement through aquifer - use through residential and industrial wells	Drinking water	Ingestion	No -drinking water well removed from contamination
		Bathing	Dermal contact Inhalation	No - well removed from contamination
		Hand washing	Dermal contact Inhalation	No - well removed from contamination
		Industrial/Household Use	- Inhalation	No
Soils (Sediments)	Contaminated fill/soil	Adsorption to dusts	Dermal contact	No
			Inhalation	No
			Ingestion	No
Surface Water	ground water discharge to Grand Calumet River	Casual contact	Dermal contact	Yes - contact probably minimal, dilution
		Volatilization/aerosols	Inhalation	Yes
			Ingestion	No - not used for drinking water
	ground water discharge to Lake Michigan	Recreation/Fishing	Dermal contact	Yes - contact probably minimal, dilution
			Inhalation	Yes
			Bioaccumulation	No - currently under investigation by U.S. Fish and Wildlife
	Ground water discharge to drainage ditch	Casual contact	Dermal contact	Yes
			Ingestion	No - not used for drinking water
		Volatilization	Inhalation	Yes
			Bioaccumulation	No - currently under investigation by U.S. Fish and Wildlife

Table 6 - 8
Midco II
Routes of Exposure Used in Calculation of Intakes

Exposure Scenario	Exposed Population	Routes of Exposure Dermal	 Ingestion	 Inhalation
On-site Scenario	Child 2-6	Play in Soil Bathing	Drinking Water PICA	Household Air Bathing
	Child 6-12	Play in Soil Play in Surface Water Bathing	Drinking Water	Household Air Bathing
	Adult	Recreation in Surface Water Bathing	Drinking Water	Household Air Bathing
Nearest Residence	Child 2-6			Household Air
	Child 6-12	Play in Surface Water		Household Air
	Adult	Recreation in Surface Water		Household Air

Table 5

Table 6 - 9
MIDCO II
Characteristics of Subchronic/Chronic Exposure Scenarios

Route of Exposure	Media	Activity	Population	Subchronic Exposure Characteristics	Chronic Exposure Characteristics
Dermal	Soil	Play	Child age 2-6 Child age 6-12	Three exposure events (hands only) at average concentration or one event at highest conc., whichever is greatest	One exposure event (hands only) per day, 150 days per year, at average concentration
	Surface Water	Recreation	Child age 6-12 Adult	Three hours of exposure (20% of body) at average concentration or one hour at highest concentration, whichever is greatest	One hour of exposure (20% of body), 150 days per year, at average concentration
	Ground Water	Showering/ Bathing	Child age 2-6 Child age 6-12 Adult	One hour of exposure (80% of body) at average concnetration or 20 min. at highest concentration, whichever is greatest	20 minutes of exposure (80% of body) at average concentration 365 days/year
Ingestion	Soil	Pica	Child age 2-6	5 gram per day at average concentration or 1 grams at highest concentration, whichever is greatest	1 gram per day, 150 days per year, at average concentration
	Ground Water	Drinking Water	Child age 2-6 Child age 6-12	3 liters at average concentration or 1 liter at highest concentration whichever is greatest	1 liter per day, 365 days per year, at average concentration
			Adult	6 liters at average concentration or 2 liters at highest concentration, whichever is greatest	2 liters per day, 365 days per year, at average concentration

Table 6 - 9 (continued)

MIDCO II

Characteristics of Subchronic/Chronic Exposure Scenarios (Continued)

Route of Exposure	Media	Activity	Population	Subchronic Exposure Characteristics	Chronic Exposure Characteristics
Inhalation	Combined Soil/ Surface Water Emission	Home	Child age 2-6 Child age 6-12	24 hours of exposure 160 m on-site and 1609 m off-site from source at average predicted emission rate or 18 hr at highest predicted emission rate, whichever is greatest	18 hours of exposure, 365 days per year, 160 m from source on-site and 1609 m from source off-site at average predicted emission rate
			Adult	24 hours of exposure 160 m on-site and 1609 m off-site from source at average predicted emission rate or 16 hr at highest predicted emission rate, whichever is greatest	16 hours of exposure, 365 days per year, 160 m from source on-site and 1609 m from source off-site at average predicted emission rate
	Ground Water	Showering/ Bathing	Child age 2-6 Child age 6-12 Adult	One hour of exposure at average concentration or 20 minutes at highest concentration, whichever is greatest	20 minutes of exposure, 365 days per year at average concentration
		Home	Child age 2-6 Child age 6-12	24 hours of exposure at 0.0001 x the average ground water conc. or 16 hours at 0.0001 x the highest concentration, whichever is greatest	16 hours of exposure, 365 days per year, at 0.0001 x the average ground water concentration
			Adult	24 hours of exposure at 0.0001 x the average ground water conc. or 16 hours at 0.0001 x the highest concentration, whichever is greatest	16 hours of exposure, 365 days per year, at 0.0001 x the average ground water concentration

Table 6

TABLE 1-14

MIDCO II

LOCATION-SPECIFIC REQUIREMENTS

LOCATION	REQUIREMENT AND CITATION	APPLICABILITY
Within 100 year floodplain	TSD facility must be designed, constructed, operated, and maintained to avoid washout (40 CFR 264.18(b))	Not applicable
Within floodplain	Action in floodplain to avoid adverse effects, minimize potential harm, restore and preserve natural and beneficial values (Executive Order 11988, Protection of Floodplains, (40 CFR 6, Appendix A))	Not applicable
Within salt dome formation, underground mine, or cave	RCRA hazardous waste placement of non-containerized or bulk liquid hazardous waste probibited (40 CFR 264.18)c))	Not applicable
Within area where action may cause irreparable harm, loss, or destruction of significant artifacts	Action to recover and preserve artifacts (National Archeological and Historical Preservation Act (16 U.S.C. Section 469; 36 CFR Part 65)	Not applicable
Historic project owned or controlled by federal agency	Action to preserve historic properties; planning of action to minimize harm to National Historic Landmarks (National Historic Preservation Act Section 106 (16 U.S.C. 470 et seq.; 36 CFR Part 800)	Not applicable
Critical habitat upon which endangered species or threatened species depends	Action to conserve endangered species or threatened species, including consultation with the Department of Interior (Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.; 50 CFR Part 200, 50 CFR Part 402)	Not applicable
Wetland	Action to minimize the destruction, loss, or degradation of wetlands (Executive Order 11990, Protection of Wetlands, 40 CFR 6, Appendix A)	Applicable to wetlands on or near site
Wetland	Action to prohibit discharge of dredged or fill material into wetland without permit (Clean Water Act Section 404; 40 CFR Parts 230, 231)	Applicable to wetlands on or near site
Wilderness area	Federally-owned area designated as wilderness area must be administered in such manner as will leave it unimpaired as wilderness and to preserve its wilderness character (Wilderness Act (16 U.S.C. 1131 et seq.); 50 CFR 35.1 et seq.)	Not applicable
Wildlife refuge	Only action allowed under the provisions of 16 U.S.C. Section 668 dd(c) may be undertaken in areas that are part of the National Wildlife Refuge System (U.S.C. 668dd et seq.; 50 CFR Part 27)	Not applicable
Area affecting stream or river	Action during diversion, channeling or other activity that modifies a stream or river and affects fish or wildlife (Fish and Wildlife Coordination Act [16 U.S.C. 661 et. seq., 40 CFR 6.302])	Applicable to stream or river on or near site affected by remediation activities
Within area affecting national wild, scenic, or recreational river	Avoid taking or assisting in action that will have direct adverse effects of scenic river (Scenic Rivers Act (16 U.S.C. 1271 et seq. Sectin 7 (a)); 40 CFR 6.302 (e))	Not applicable
Within coastal zone	Conduct activities affecting the coastal zone in manner consistent with approved State management programs (Coastal Zone Management Act (16 U.S.C. Section 1451 et seq.))	Not applicable
Oceans or waters of the United States	Action to dispose of dredge and fill material is prohibited without a permit (Clean Water Act Section 404 CFR 125 Subpart M; Marine Protection Resources and Sanctuary Act Section 103)	Applicable to stream or river on or near site affected by remediation activities
Within 200 feet of fault displaced in Halocene time	New treatment, storage or disposal of hazardous waste prohibited (40 CFR 264.18(a))	Not applicable
Migratory bird flight pattern	Migratory Bird Treaty Act	Applicable to area affected by by remediation activities
Area affecting lakes and streams	Andromous Fish Conservation Act	Applicable to lake or stream on or near site affected by remediation activities
Habitat for marine mammals	Marine Mammal Protection Act	Not applicable
Lake in Indiana	Lake Preservation Act (13-2-11.1)	Not applicable
Within floodplain in Indiana	Flood Control Act (13-2-22)	Not applicable
Indiana habitat upon which nongame or endangered species depend	Nongame and Endangered Species Act (14-2-8)	Not applicable
Within Indiana nature preserve	Nature Preserves Act (14-4-5)	Not applicable

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Table 7

TABLE 1-15

MIDCO II
ACTION-SPECIFIC REQUIREMENTS

Action	Requirement and Citation
Air Stripping	Proposed standards for control of emissions of volatile organics.
Capping	Placement of cap over waste requires a cover designed and constructed to: o Provide long-term minimization of migration of liquids through the capped area; o Function with minimum maintenance; o Promote drainage and minimize erosion or abrasion of the cover; o Accomodate settling and subsidence so that the cover's integrity is maintained; and o Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present. Eliminate free liquids by removal or solidification. Restrict use of property as necessary to prevent damage to cover. Prevent run-on and run-off from damaging cover. Stabilization of remaining waste to support cover. [40 CFR 264]
Consolidation	Placement on or in land outside unit boundaries or area of contamination will trigger land disposal requirements and restrictions. [40 CFR 268 (Subpart D)]

TABLE 1-15 (continued)

Page 2 of 9

Action	Requirement and Citation
Direct Discharge of Treatment System Effluent	Use of best available technology (BAT) economically achievable is required to control toxic and nonconventional pollutants. Use of best conventional pollutant control technology (BCT) is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. [40 CFR 122.44(a)]
	Applicable federally approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA. [40 CFR 122.44 and state regulations approved under 40 CFR 131]
	Applicable federal water quality criteria for the protection of aquatic life must be complied with when environmental factors are being considered. [50 FR 30784]
	The discharge must conform to applicable water quality requirements when the discharge affects a state other than the certifying state. [40 CFR 122.44(d)]
	The discharge must be consistent with the requirements of a Water Quality Management Plan approved by EPA. [40 CFR 122.44(d)]
	Discharge limitations must be established for all toxic pollutants that are or may be discharged at levels greater than that which can be achieved by technology-based standards. [40 CFR 122.44(e)]
	Develop and implement a BMP program and incorporate in the NPDES permit to prevent the release of toxic constituents to surface waters. [40 CFR 125.100]

TABLE 1-15 (continued)

Page 3 of 9

Action	Requirement and Citation
	The BMP program must: o Establish specific procedures for the control of toxic and hazardous pollutant spills; o Include a prediction of direction, rate of flow, and total quantity of toxic pollutants where experience indicates a reasonable potential for equipment failure; and o Assure proper management of solid and hazardous waste in accordance with regulations promulgated under RCRA. [40 CFR 125.104]
	Discharge must be monitored to assure compliance. [40 CFR 122.44(i)]
	Approved test methods for waste constituents to be monitored must be followed. Detailed requirements for analytical procedures and quality controls are provided.
	Sample preservation procedures, container materials, and maximum allowable holding times are prescribed. [40 CFR 136.1-136.4]
	Permit application information must be submitted including a description of activities, listing of environmental permits, etc. [40 CFR 122.21]
	Monitor and report results as required by permit. [40 CFR 122.44(i)]
	Comply with additional permit conditions. [40 CFR 122.41(i)]

TABLE 1-15 (continued)

Page 4 of 9

Action	Requirement and Citation
Discharge to POTW	Pollutants that pass through the POTW without treatment, interfere with POTW operation, or contaminate POTW sludge are prohibited. Specific prohibitions preclude the discharge of pollutants to POTWs that: o Create a fire or explosion hazard in the POTW; o Are corrosive (pH <5.0); o Obstruct flow resulting in interference; o Are discharged at a flow rate and/or concentration that will result in interference; o Increase the temperature of wastewater entering the treatment that would result in interference but in no case raise the POTW influent temperature above 104°F; Discharge must comply with local POTW pretreatment program; and [40 CFR 403.5 and local POTW regulations] RCRA permit-by-rule requirements must be complied with for discharges of RCRA hazardous wastes to POTWs by rail, truck, or dedicated pipe. [40 CFR 264.71 and 264.72]
Discharge of Dredge and Fill Material to Navigable Waters	The four conditions that must be satisfied before dredge and fill is an allowable alternative are: o There must be no practicable alternative; o Discharge of dredged or fill material must not cause a violation of state water quality standards, violate any applicable toxic effluent standards, jeopardize an endangered species, or injure a marine sanctuary;

TABLE 1-15 (continued)

Page 5 of 9

Action	Requirement and Citation
	o No discharge shall be permitted that will cause or contribute to significant degradation of the water; o Appropriate steps to minimize adverse effects must be taken; and o Determine long- and short-term effects on physical, chemical, and biological components of the aquatic ecosystem. [40 CFR 230.10 and 33 CFR 320-330]
Excavation	Movement of excavated materials containing RCRA hazardous wastes to new location and placement in or on land will trigger land disposal restrictions.
Ground Water Diversion	Excavation of RCRA hazardous waste for construction of slurry wall may trigger cleanup or land disposal restrictions.
Incineration (On-Site)	Analyze the RCRA hazardous waste feed [40 CFR 264.341] Dispose of all hazardous waste and residues including ash, scrubber water, and scrubber sludge. [40 CFR 264.351] Performance standards for incinerators: o Achieve a destruction and removal efficiency of 99.99 percent for each principal organic hazardous constituent in the waste feed; and [40 CFR 264.343] o Reduce hydrogen chloride emissions to 1.8 kg/hr or 1 percent of the HCL in the stack gases before entering any pollution control devices. [40 CFR 264.342]

TABLE 1-15 (continued)

Page 6 of 9

Action	Requirement and Citation
	Monitoring of various parameters during operations of the incinerator is required. These parameters include: o Combustion temperature; o Waste feed rate; o An indicator of combustion gas velocity; and o Carbon monoxide.
	Special performance standard for incineration of PCBs. [40 CFR 7611.70]
	Special requirements for incineration by Indiana Department of Environmental Management, including a trial burn and extensive sampling.
Land Treatment	Ensure that hazardous constituents are degraded, transformed, or immobilized within the treatment zone. [40 CFR 264.271]
	Maximum depth of treatment zone must be no more than 50 feet from the initial soil surface, and more than 3 feet above the seasonal high water table. [40 CFR 264.271]
	Demonstrate that hazardous constituents for each waste can be completely degraded, transformed, or immobilized in the treatment zone. [40 CFR 264.271]
	Minimize run-off of hazardous constituents. [40 CFR 264.273]
	Maintain run-on and run-off controls and management system. [40 CFR 264.273]
	Unsaturated zone monitoring. [40 CFR 264.281]
	Special requirements for ignitable or reactive waste. [40 CFR 264.282]

TABLE 1-15 (continued)

Page 7 of 9

Action	Requirement and Citation
	Special requirements for incompatible wastes. [40 CFR 264.282]
	Special requirements for F020, F021, F022, F023, F026, and F027 wastes. [40 CFR 264.283]
Slurry Wall	Excavation of RCRA hazardous waste for construction of slurry wall may trigger cleanup or land disposal restrictions. [40 CFR 268]
Treatment	Proposed standards for miscellaneous units require new units to satisfy environmental performance standards by protection of ground water, surface water, and air quality, and by limiting surface and subsurface migration. Treatment of wastes subject to ban on land disposal must attain levels achievable by best demonstrated available treatment technologies (BDAT) for each hazardous constituent in each listed waste. [40 CFR 268.10-13] BDAT standards for spent solvent wastes are based on one of four technologies. Any technology may be used; however, if it will achieve the concentration levels specified. [RCRA Sections 3004(d)(e).(e)(3) 42 U.S.C. 6924(d)(3).(e)(3)]
Underground Injection of Wastes and Treated Ground Water	UIC program prohibits: [40 CFR 144.12] o Injection activities that allow movement of contaminants into underground sources of drinking water and results in violations of MCLs or adversely affects health; and o Construction of new Class IV wells, and operation and maintenance of existing wells. [40 CFR 144.13]

TABLE 1-15 (continued)

Action	Requirement and Citation
	Wells used to inject contaminated ground water that has been treated and is being reinjected into the same formation from which it was drawn are not prohibited if activity is part of CERCLA action. [40 CFR 144.13]
	All hazardous waste injection wells must comply with the RCRA requirements. [40 CFR 144.16]
	Owners and operators must: [40 CFR 144.26-27]
	o Submit inventory information to the director of the state UIC program;
	o Report non-compliance orally within 24 hours; and
	o Prepare, maintain and comply with plugging and abandonment plan.
	Monitor Class I wells by:
	o Frequent analysis of injection fluid;
	o Continuous monitoring of injection pressure;
	o flow rate and volume; and
	o Installation and monitoring of ground water monitoring wells.
	Applicants for Class I permits must: [40 CFR 144.55]
	o Identify all injection wells within the area of review; and
	o Take action as necessary to ensure that such wells are properly sealed, completed, or abandoned to prevent contamination of USDW.

TABLE 1-15 (continued)

Page 9 of 9

Action	Requirement and Citation
	Criteria for determining whether an aquifer may be determined to be an exempted aquifer include current and future use, yield, and water quality characteristics. [40 CFR 146.4]
	Case and cement all Class I wells to prevent movement of fluids into USDW, taking into consideration well depth, injection pressure, hole size, composition of injected waste and other factors.
	Conduct appropriate logs and other tests during construction and a descriptive report prepared and submitted to the UIC Program Director.
	Injection pressure may not exceed a maximum level designed to ensure that injection does not initiate new fractures or propagate existing ones and cause the movement of fluids into a USDW. [40 CFR 146.13]
	Continuous monitoring of injection pressure, flow rate, and volume, and annual pressure, if required.
	Demonstration of mechanical integrity is required every 5 years.
	Ground water monitoring may also be required.

Table 8

TABLE 4-10

ALTERNATIVES' COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS

Law or Regulation	Comment	1	2	3	4A	4B	4C	4E	5A	5C	5E	5G	6	7	8	9
FEDERAL																
Resource Conservation and Recovery (RCRA) - Subtitle C																
40 CFR 262 Standard for Generators	Alternative will involve treatment/disposal of hazardous waste. RCRA generator regulations apply.				x	x	x	x	x	x	x		x	x	x	x
40 CFR 264-265 Standards for owners and operators of hazardous waste treatment, storage and disposal facilities.	Alternative will require use of a RCRA-permitted facility in compliance with current RCRA regulations.				x	x	x	x	x	x	x	x	x	x	x	x
DOT Hazardous Materials Transport Rules (49 CFR Subchapter C) and RCRA - Subtitle C Standards for Transporters 40 CFR 263	Implementation of this alternative includes the off-site transport of hazardous materials. The transport of these materials will be in compliance with these rules, including use of properly constructed and marked transport vehicles, use of a licensed transporter, and use of hazardous waste manifests.				x	x	x	x	x	x	x		x	x	x	x
Clean Water Act (CWA)																
40 CFR Parts 122, 125 and Subpart N National Pollutant Discharge Elimination System (NPDES)	Indiana has authorization to administer NPDES in Indiana. Refer to section on state regulation.															
40 CFR 403 Effluent Guidelines and Standards - Pretreatment Standards	Indiana has authorization to administration pretreatment in Indiana Refer to section on state regulations.															
Federal Water Quality	Alternatives may not result in compliance with FWQC in surface water.	x	x						x	x	x	x				
EPA Ground Water Protection Strategy	This alternative will not attain EPA's ground water protection strategy goals for aquifer.	x	x						x	x	x	x				
Occupational Safety & Health Act (OSHA) Part 1910 (OSHA Standards)	Implementation of this alternative will require work on the site. Working conditions must assure safety and health of workers.		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Toxic Substances Control Act (TSCA) 40 CFR 761	Alternative may require disposal of PCB-contaminated material; however, PCB levels are not at concentrations triggering disposal requirements.			x					x	x	x	x	x	x	x	x
Intergovernmental Review of Federal Programs 40 CFR 29	Alternative will require intergovernmental review of project if project will use federal funds.		x	x	x	x	x	x	x	x	x	x	x	x	x	x
National Primary Drinking Water Standards	Alternative will not result in compliance with standards	x	x						x	x	x	x				
Ambient Water Quality Criteria	Alternative will not result in compliance with criteria.	x	x						x	x	x	x				

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TABLE 4-10

ALTERNATIVES' COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS

Law or Regulation	Comment	Alternative 1	2	3	4A	4B	4C	4E	5A	5C	5E	5G	6	7	8	9
Clean Air Act (CAA)	Implementation of this alternative may result in the emission of pollutants into the air though below regulatory limits. A Permit should not be required, but necessary technical requirements will be met.					X	X	X	X	X	X	X	X	X	X	X
	On-site excavation may result in the short-term emission of particulates. On-site personnel will be adequately protected. Efforts to mitigate release will be made.			X					X	X	X		X	X	X	X
Safe Drinking Water Act, Underground Injection Control (UIC) Program: Criteria and Standards (40 CFR Part 146)					X	X	X	X	X					X	X	
Underground Injection Well Permit					X	X	X							X	X	
Marine Protection, Research and Sanctuaries Act (40 CFR Part 220-229) Ocean Dumping Requirements	Implementation of the alternatives does not include the dumping of any materials in the ocean or incineration at sea.															
Radioactive Waste Rule -- High Low Level	Existing records indicate that the site does not contain high- or low-level radioactive waste.															
National Register of Historic Places	Implementation of the alternatives will not affect sites on the register.															
Wild and Scenic Rivers Act (40 CFR Part 6.302)	Rivers on the national inventory will not be affected by alternatives.															
Endangered Species Act Protection of Threatened or Endangered Species and Their Habitats (50 CFR Part 402)	Implementation of the alternatives will not affect threatened or endangered species and their habitat.															
Fish and Wildlife Act Conservation of Wildlife Resources	Implementation of the alternatives will not affect areas of important wildlife resources.															
Coastal Zone Management Act (15 CFR 920-926)	Implementation of the alternatives will not affect a coastal zone.															
Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1979 (40 CFR 4)	Implementation of the alternatives should not require relocation of residences or businesses or acquisition of property.															
Executive Orders for Flood Plain (EO11988)	Implementation of this alternative will not occur in a flood plain.															
Executive Orders for Wetlands (EO11990)	Implementation of this alternative may affect a wetland.			X	X	X	X	X	X	X	X	X	X	X	X	X
National Environmental Policy Act (NEPA)	CERCLA actions are exempted from NEPA requirements.															
Archaeological and Historic Preservation Act of 1974	Alternatives should not affect these resources.															

TABLE 4-18

ALTERNATIVES' COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS

Law or Regulation	Comment	Alternative														
		1	2	3	4A	4B	4C	4E	5A	5C	5E	5G	6	7	8	9
STATE																
Indiana Hazardous Waste Management Program - Indiana Environmental Management Board Article 4 (320-IAC-4)																
Rules 2, 3, 4, Waste Generation Identification Standards for Generators	This alternative will involve off-site disposal of hazardous waste and generator regulations apply.					x	x	x	x						x	x
Rule 5 Standards Applicable	Implementation of this alternative includes the off-site transport of hazardous materials. The transport of these materials will be in compliance with these rules, including use of properly constructed and marked transport vehicles, use of licensed transporters, and use of hazardous waste manifests.					x	x	x	x						x	x
Rule 6 Standards Applicable to Owners and Operators of Hazardous Waste Facilities				x	x	x	x	x	x	x	x	x	x	x	x	x
Rule 7 Closure/Postclosure	This alternative will be consistent with current state regulations although no permit will be required.			x	x	x	x	x	x	x	x	x	x	x	x	x
Rule 8-9 Hazardous Waste Facility Construction and Operating Permit	This alternative will require the use of a state-permitted facility in compliance with current state regulations.			x	x	x	x	x	x	x	x	x	x	x	x	x
Indiana Waste Treatment Facilities Regulation - Title 330 - Article 3.1 Facility Construction	This alternative will require construction of a waste treatment facility and will be consistent with the technical requirement of Article 3.1.					x	x	x		x	x				x	x
Article 5 Industrial Wastewater Pretreatment and NPDES Programs - Rules 1 - 10	Implementation of alternative will not result in an on-site point source discharge. An NPDES permit will not be required.															
Rules 11-15 Pretreatment Standards	Not applicable. Implementation of alternatives will not result in discharge of a waste stream to a publicly-owned treatment works (POTW).															
Indiana Water Quality Standards Stream Pollution Control Board 330 IAC Article 1-2, Section 6 Water Quality Standard	Implementation of alternatives will not result in noncompliance with Indiana Water Quality Standards.															
Indiana Air Pollution Control	Alternatives will be consistent with the technical requirement of current Indiana regulation.		x	x	x	x	x	x	x	x	x	x	x	x	x	x
LOCAL																
Zoning	Alternatives may require no zoning change.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

TABLE 9

COMPARISON OF CONCENTRATIONS OF INORGANICS IN SUBSURFACE MATERIAL AT MIDCO I WITH CONCENTRATIONS IN LISTED HAZARDOUS WASTES (FROM BDAT BACKGROUND DOCUMENTS FOR THE FIRST THIRD WASTES UNDER LAND BAN)

	CONSTITUENT CONCENTRATIONS (mg/kg)			
Source	Arsenic	Chromium	Lead	Cadmium
K101	590-1950			
K102	3060-8320			
K061		1730	20300	44
K046			967	
K048		0.04-3435	0.05-1250	
K049		28.9-1400	21.95-3900	
K050		11-1600		
K051		0.1-6790		0.25-2480
K052			11-5800	
Midco II On-Site Soils	ND-1430	ND-1960	2.5-2810	ND-26

TABLE 4-2

MIDCO II

EFFECTIVENESS EVALUATION OF ALTERNATIVES

	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT SHORT TERM	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT LONG TERM	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME
Alternative 1	Does not reduce potential public health risk associated with contaminated soils if excavated and exposed or ground water if ingested. Would not comply with chemical and location-specific requirements as well as criteria, advisories and guidance.	Public health risk exists for ingestion or dermal absorption of excavated soils and ground water contaminants and for dermal absorption of surface water. Increased lifetime cancer risk to future on-site residents (1.6 x 10^{-2}) is unacceptable. Future exposure to residual contaminants cannot be prevented.	Toxicity, mobility, or volume of contaminants in soil and ground water are not permanently or significantly reduced.
Alternative 2	Existing risks would be reduced for on-site soil and ground water ingestion and dermal absorption. This requires successful enforcement of deed restrictions and maintenance of the site, fencing, and erosion protection. Potential for contaminated ground water degradation would be lessened by inhibiting surface moisture infiltration (and thus, contact with potential contaminants). Risks to the workers and the community during remedial action can be adequately controlled by restricting access to site to authorized personnel only, and conducting action with adequate health and safety precautions. Final protection from exposure to on-site contamination is achieved upon completion of cap construction, approximately 1 year after initiation of construction.	Cleanup action levels (CALs) for soil and ground water will not be met as soil remains without treatment and ground water that has migrated off site will not be treated. Continued potential for ground water degradation exists due to lateral ground water migration. Surface water contaminants may be worsened by continual discharge of contaminated ground water. Deed restrictions and site maintenance are provided. Need for replacement will be based on site maintenance over time. Performance of properly installed multi-layered cap is generally good for first 20 years of service. Integrity of synthetic liner after this time becomes uncertain and should be investigated regularly. Punctures of the liner by deep rooted plants and burrowing animals will affect the performance of the cap. If remedial action fails, risk is similar to no-action alternative. The cost for remedying failure would be similar to the cost of original installation if it is detected before more ground water moves off site and if the area needing repair could be located. If not, cost to remedy will involve, as a minimum, a ground water option to remove the escaping contaminants. Contamination may move vertically through to the next aquifer. This aquifer has very little yield, and is not used for drinking water purposes. Monitoring of the confining layer should detect movement. A ground water extraction system could be employed if warranted by sampling. Costs would be similar to ground water options. Without ground water use restrictions, the remaining risk at the site after remediation completion is 1.6 x 10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels.	Reduces mobility of contaminants in soil but does not significantly or permanently reduce toxicity or volume or reduce the mobility of contaminants that are already in the ground water.

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TABLE 4-2

MIDCO II

EFFECTIVENESS EVALUATION OF ALTERNATIVES

	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT SHORT TERM	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT LONG TERM	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME
Alternative 3	Safety concern during installation related to excavation activities. Risks to workers and community during remedial action can be adequately controlled by restricting access to the site to authorized personnel only, and conducting action with adequate health and safety precautions. Protection against principle threat can be achieved upon completion of construction, approximately 1 to 2 years.	Cleanup action levels (CALs) for soil and ground water will not be met because no treatment is provided for either. Eliminates direct contact exposure to contaminants. Contamination may move vertically to next aquifer. This aquifer has very little yield, and is not used for drinking water purposes. Monitoring of the confining layer should detect movement. A ground water extraction system could be employed if warranted by sampling. Costs would be similar to ground water options. Long-term access restriction would prevent future exposure to residuals. In contaminated environment, effectiveness over long-term depends on type of contaminants and concentrations. High salt and organic concentrations may effect permeability of wall, resulting in need to replace system in long term. If failed, risks are similar to no-action. The cost for remedying failure would be similar to, but higher than, the cost of original installation if it is detected before more ground water moves off site and if the area needing repair could be located. If not, cost to remedy will involve, as a minimum, a ground water option to remove the escaping contaminants. After remediation is completed, all risks are reduced below acceptable levels.	Significantly reduces mobility of contaminants in soil and ground water, but does not reduce toxicity or volume.
Alternative 4A	Protection will be achieved by interception of ground water, capping, deed restriction, and site maintenance. Remedial action activities may not commence for 1 to 2 years, as a Petition Demonstration for deep well must be approved by EPA. Construction of remedial action should take 2 years. Risks to workers and community during remedial action can be adequately controlled by restricting access to site to authorized personnel only and conducting action with adequate health and safety precautions.	Cleanup action levels (CALs) for soil will not be met as soil remains without treatment. The ground water that has migrated off site will be removed where CALs are exceeded and ground water CALs on site would be met. A cap and access restriction will prevent soil ingestion and dermal absorption. Potential for failure of technical components is small, but will require routine maintenance and replacement. If failed, risks at site are similar to no-action. If contaminants leave deep aquifer, cost to remedy will be many times the cost of original remediation due to great depth and difficulty of monitoring. After remediation is completed, if deed restriction and site maintenance are performed, all risks are reduced below acceptable levels.	Significantly and permanently reduces mobility of contaminants in the soil but does not reduce toxicity or volume of some contaminants in soil. Significantly and permanently reduces mobility of contaminants in ground water but does not reduce toxicity or volume.
Alternative 4B	Protection will be achieved by interception of ground water, capping, deed restriction, and site maintenance. Remedial action activities may not commence for at least 1 year, as approval for this option must be obtained. Construction of remedial action should take 2 years. Risks to workers and community during remedial action can be adequately controlled by restricting access to site to authorized personnel only and conducting action with adequate health and safety precautions.	Cleanup action levels (CALs) for soil will not be met as soil remains without treatment. The ground water that has migrated off site will be removed where CALs are exceeded and ground water CALs on site would be met. A cap and access restriction will prevent soil ingestion and dermal absorption. Technical components of remedy will require routine operation, maintenance and replacement. If fails, risks at site are similar to no-action. If contaminants leave deep aquifer, cost to remedy will be many times the cost of original remediation due to great depth and difficulty of monitoring. After remediation is completed, if deed restrictions and site maintenance are performed, all risks are reduced below acceptable levels.	Significantly and permanently reduces mobility of contaminants in the soil but does not reduce toxicity or volume of some contaminants in soil. Significantly and permanently reduces mobility and toxicity of contaminants in ground water but does not reduce volume. Some contaminants in ground water are transferred to carbon canisters which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.

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EFFECTIVENESS EVALUATION OF ALTERNATIVES

	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT SHORT TERM	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT LONG TERM	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME
Alternative 4C	Protection will be achieved by interception of ground water, capping, deed restriction, and site maintenance. Approval for this option should not unduly slow action down as contaminants will be removed to drinking water quality except salinity before injection. Construction of remedial action should take 2 years. Risks to workers and community during remedial action can be adequately controlled by restricting access to site to authorized personnel only and conducting action with adequate health and safety precautions.	Cleanup action levels (CALs) for soil will not be met as soil remains without treatment. The ground water that has migrated off site will be removed where CALs are exceeded and ground water CALs on site would be met. The level of acetone being injected into the deep well may exceed the CAL. No MCL or MCLG presently exists for acetone. A cap and access restriction will prevent soil ingestion and dermal absorption. Potential for failure of technical components is increased due to further complexity of treatment processes and will require regular operation, maintenance, and replacement. If fails, risks at site are similar to no-action. If water leaves deep aquifer, since this is not a drinking water aquifer, the increased salinity should not pose a problem. After remediation is completed, if deed restrictions and site maintenance are performed, all risks are reduced below acceptable levels.	Significantly and permanently reduces mobility of contaminants in the soil but does not reduce toxicity or volume of some contaminants in soil. Significantly and permanently reduces mobility and toxicity of contaminants in ground water but does not reduce volume. Some contaminants in ground water are transferred to carbon canisters and metals sludges which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.
Alternative 4F	Protection against principle threat will be achieved by interception of ground water, capping, deed restriction and site maintenance. Approval for the evaporator system should be readily obtainable as this is conventional technology. Construction of remedial action should take 1 to 2 years. Risk to workers and community during remedial action can be adequately controlled by restricting access to site and conducting action with adequate health and safety precautions.	Cleanup action levels (CALs) for soil will not be met as soil remains without treatment. The ground water that has migrated off site will be removed where CALs are exceeded and ground water CALs on site would be met. A cap and access restriction will prevent soil ingestion and dermal absorption. Technical components of action should not fail with adequate operation and maintenance. After remediation is completed, if deed restrictions and site maintenance are performed, all risks are reduced below acceptable levels.	Significantly and permanently reduces mobility of contaminants in soil but does not reduce toxicity or volume of some contaminants in soil. Significantly and permanently reduces mobility, toxicity and volume of contaminants in ground water. Some contaminants in ground water are transferred to salt crystals which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.
Alternative 5A	Safety concerns during the remedial action are related to the excavation of the material. Risk to the workers and the community can be adequately controlled by restricting access to the site and conducting action with adequate health and safety precautions.	Cleanup action levels for soils above ground water level would be met. CALs for soils below ground water may not be met; however, risk calculations are based on ingestion of soil, and these additional solids would be below the water table and unavailable for ingestion. Attenuation results in a dissipation of contaminants, although it will be many years before ground water cleanup action levels will be attained for all compounds. Future exposure to residuals is minimized, because material removed from site. Remedial alternative transfers the problems to the landfill. Without ground water use restrictions, the remaining risk at the site after remediation completion is 1.6 x 10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels.	Reduces volume of contaminants in soil by removing it from site but transfers the problem to the landfill site. Does not reduce volume, mobility or toxicity of contaminants in ground water.

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MODULE II

EFFECTIVENESS EVALUATION OF ALTERNATIVES

	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT SHORT TERM	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT LONG TERM	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME
Alternative 5C	Safety concerns during the remedial action are related to the excavation of the material. Risk to the workers and the community can be adequately controlled by restricting access to the site, conducting action with adequate health and safety precautions, and providing adequate emissions control. It will be necessary to perform treatability studies to adequately demonstrate that the solidified ash can conform to procedures similar to delisting. Due to extensive technical requirements/submittals (including a trial burn) as well as the backlog at DEM, remediation of the soils may not begin for up to 2 years. Completion of construction should be less than 1 year. The actual soil remediation should be less than 1 year.	Cleanup action levels for soils above ground water level would be met. CALs for soils below ground water may not be met; however, risk calculations are based on ingestion of soil, and these additional solids would be below the water table and unavailable for ingestion. Attenuation results in a dissipation of contaminants, although it will be many years before ground water cleanup action levels will be attained for all compounds. Future exposure to residuals would be minimal. If fails, risks are similar to no action. The cost for remedying failure of solidification would be similar to the cost of original installation. Without ground water use restrictions, the remaining risk at the site after remediation completion is 1.6×10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels.	Significantly and permanently reduces toxicity and mobility of contaminants in soil, but does not reduce toxicity, mobility of volume of contaminants in ground water.
Alternative 5E	Safety concern during installation associated with excavation and mixing of contaminated material. Risk to workers and community during remedial action can be adequately controlled by restricting access and conducting actions with adequate health and safety precautions. It will be necessary to perform treatability studies to adequately demonstrate that the solidified waste can conform to procedures similar to RCRA delisting. This may delay initiation of construction. Completion of construction should be 1 year.	Cleanup action levels for soils above ground water level would be met. CALs for soils below ground water may not be met; however, risk calculations are based on ingestion of soil, and these additional solids would be below the water table and unavailable for ingestion. Attenuation results in a dissipation of contaminants, although it will be many years before ground water cleanup action levels will be attained for all compounds. Future exposure to residuals would be minimal. If treatability studies are properly conducted, there should be a lower likelihood for needing replacement. If fails, risks are similar to no action. The cost for remedying failure would be similar to the cost of original installation. Without ground water use restrictions, the remaining risk at the site after remediation completion is 1.6×10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels.	Significantly and permanently reduces mobility of contaminants in soil, but does not reduce toxicity, mobility or volume of contaminants in ground water.
Alternative 5G	Because no excavation of material occurs and all of the materials are treated in a hood, risk is minimized. Risk to workers and community during remedial action can be adequately controlled by restricting access and providing adequate health and safety precautions. Completion of construction should be 1 to 2 years.	Cleanup action levels for soils above ground water level would be met. CALs for soils below ground water may not be met; however, risk calculations are based on ingestion of soil, and these additional solids would be below the water table and unavailable for ingestion. Attenuation results in a dissipation of contaminants, although it will be many years before ground water cleanup action levels will be attained for all compounds. Alternative has been evaluated on pilot scale. Technology has not been proven on full scale project. Therefore need for replacement is unknown at this time. This option may preclude some types of future remedial action due to creation of solid monolith. Future exposure to residuals would be minimal. If treatability studies are properly conducted, there should be a lower likelihood for needing replacement. The cost for remedying failure would be similar to the cost of original installation. Without ground water use restrictions, the remaining risk at the site after remediation completion is 1.6×10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels.	Significantly and permanently reduces toxicity, mobility and volume of contaminants in soil, but does not reduce toxicity, mobility, or volume of contaminants in ground water.

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EFFECTIVENESS EVALUATION OF ALTERNATIVES

	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT SHORT TERM	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT LONG TERM	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME
Alternative 6	Protection achieved by containment and solidification. It will be necessary to perform treatability studies to demonstrate that the solidified waste can conform to procedures similar to RCRA delisting. This may delay construction initiation. Construction of remedial action would take 1 to 2 years. Risks to the workers and the community during remedial action can be adequately controlled by restricting access to the site to authorized personnel only and conducting action with adequate health and safety precautions.	Combines the long-term effectiveness of Alternatives 3 and 5C. Cleanup action levels for soil above ground water will be met. CALs for soil below ground water may not be met; however, risk calculations are based on ingestion of soil, and this would be unavailable for ingestion. Ground water cleanup action levels would not be met on site. Contamination may move vertically to next aquifer. Monitoring of the confining layer should detect movement. A ground water extraction system could be employed if warranted by sampling. Costs would be similar to ground water options. The cost for remedying failure would be similar to but higher than the cost of original installation if it is detected before more ground water moves off site and if the area needing repair could be located. If not, cost to remedy will involve, as a minimum, a ground water option to remove the escaping contaminants. After remediation is completed, all risks are reduced below acceptable levels.	Significantly and permanently reduces mobility of contaminants in soil and ground water.
Alternative 7	Protection against principle threat will be achieved by ground water interception and solidification. Remedial action activities for ground water may not commence for 1 to 2 years as a Petition Demonstration for the deep well must be approved. It will be necessary to perform treatability studies to demonstrate that the solidified waste can conform to procedures similar to RCRA delisting. This may delay construction initiation. Construction of the remedial action would take approximately 2 years. Risks to the workers and the community during remedial action can be adequately controlled by restricting access to the site to authorized personnel only and conducting action with adequate health and safety precautions.	Combines the long-term effectiveness of Alternatives 4A and 5C. Cleanup action levels for soil above ground water will be met. CALs for soil below ground water may not be met; however, risk calculations are based on ingestion of soil, and this would be unavailable for ingestion. Ground water cleanup action levels would be met. If contaminants leave deep aquifer, cost to remedy will be many times the cost of original remediation due to great depth and difficulty of monitoring. After remediation is completed, all risks are reduced below acceptable levels.	Permanently and significantly reduces mobility of contaminants in soil and ground water.
Alternative 8	Protection will be achieved by ground water interception/treatment and solidification. Approval for this option should not unduly slow action down as contaminants will be removed to drinking water quality except salinity before injection. It will be necessary to perform treatability studies to demonstrate that the solidified waste can conform to procedures similar to RCRA delisting. This may delay construction initiation. Construction of remedial action would take 2 years. Risks to the workers and the community during remedial action can be adequately controlled by restricting access to the site to authorized personnel only and conducting action with adequate health and safety precautions.	Combines the long-term effectiveness of Alternatives 4C and 5C. Cleanup action levels for soil above ground water will be met. CALs for soil below ground water may not be met; however, risk calculations are based on ingestion of soil, and this would be unavailable for ingestion. Ground water cleanup action levels would be met. If water leaves deep aquifer, since this is not a drinking water aquifer, the increased salinity should not pose a problem. After remediation is completed, all risks are reduced below acceptable levels.	Significantly and permanently reduces mobility of contaminants in soil and the mobility and toxicity of contaminants in ground water. Some contaminants in ground water are transferred to carbon canisters and metals sludges which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.

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EFFECTIVENESS EVALUATION OF ALTERNATIVES

	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT SHORT TERM	PROTECTIVENESS OF HUMAN HEALTH AND ENVIRONMENT LONG TERM	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME
Alternative 9	Protection will be achieved by ground water interception/evaporation and solidification. Approval for the evaporator system should be readily obtainable as this is conventional technology. It will be necessary to perform treatability studies to demonstrate that the solidified waste can conform to procedures similar to RCRA delisting. This may delay construction initiation. Construction of remedial action should take 1 to 2 years. Risks to the workers and the community during remedial action can be adequately controlled by restricting access to the site to authorized personnel only and conducting action with adequate health and safety precautions.	Combines the long-term effectiveness of Alternatives 4E and 5E. Cleanup action levels for soil above ground water will be met. CALs for soil below ground water may not be met; however, risk calculations are based on ingestion of soil, and this would be unavailable for ingestion. Ground water cleanup action levels would be met. After remediation is completed, all risks are reduced below acceptable levels.	Significantly and permanently reduces mobility of contaminants in soil and mobility, toxicity and volume of contaminants in ground water. Some contaminants in ground water are transferred to salt crystals which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.

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IMPLEMENTABILITY EVALUATION OF ALTERNATIVES

	TECHNICAL FEASIBILITY SHORT TERM	TECHNICAL FEASIBILITY LONG TERM	AVAILABILITY	ADMINISTRATIVE FEASIBILITY
Alternative 1	No remedial action is taken with this alternative; therefore, no construction difficulties will be encountered and no schedules will be delayed. No action-specific requirements are related to this alternative.	It is extremely likely that future remedial action will be required. It should be no more difficult to implement the additional remedial action than at present. Migration or exposure pathways can be readily monitored. Since no operation and maintenance is performed, long-term O&M difficulties are not anticipated.	The no-action option is a readily available technology.	It is extremely unlikely that this alternative would receive the necessary approvals from any agency or from the community. Location and chemical-specific requirements would not be met.
Alternative 2	Short-term technical feasibility of alternative is adequate. Technologies can be constructed as needed for specific site in a reasonable time period and should perform as expected during the remedial action if proper maintenance is performed. Cap construction will comply with action-specific requirements.	It is probable that future remedial action would be required if contaminants move off site with the ground water. Installation of the cap should not preclude possible future remedial actions. The site can be readily monitored and maintained. This alternative would have low implementation, operation and maintenance costs. Long-term mainten-ance problems may arise from synthetic liner puncture or poor maintenance.	The cap installers should be readily available. These installers would be trained in the operation of the necessary equipment as well as appropriate health and safety precautionary measures.	Construction of the cap must provide long-term minimization of migration of liquids through the cap area. It is unlikely that the community response to this alternative will be favorable, as contaminants may continue to leave the site. While most location-specific requirements may be met, chemical-specific requirements will not. Enforcement of ground water use restrictions may be very difficult.
Alternative 3	Attapulgite clay rather than Wyoming clay may be needed. It is anticipated that an adequate supply of clay can be obtained. It is expected that with proper bench-scale testing and installation, technology will be capable of meeting performance specifications. Action-specific requirements will be met. Excavation will take place outside the area requiring soil remediation. Therefore, construction should not trigger cleanup or land disposal restrictions.	Future remedial action such as ground water extraction and treatment may be required if it is determined that the contaminants are moving through the confining layer beneath the site. While future remedial actions are not precluded by the current action, the construction of a wall and cap could effect the construction of future remedial action. Monitoring of the site for effectiveness should be no problem. Difficulties with long-term O&M may arise from action of the contaminants, especially the salt and organics, on the wall itself.	Containment walls are a demonstrated technology that are readily available and easy to construct. Adequate clay should be available. The necessary equipment and specialists should be available and trained in the necessary health and safety techniques. Lack of commercial deep well facilities may affect alternative. Presently deep well facilities are available.	Acceptance of this alternative would be possible. A condition of the acceptance would include deed and access restrictions, as well as careful monitoring, to ensure the waste is not moving through to the next aquifer.
Alternative 4A	It is expected that the biggest difficulty with the option will be in obtaining approval of the Petition Demonstration. This could result in problems with the remedial schedule. It is expected that all action-specific requirements can be achieved.	Assuming that the extraction wells are properly placed to influence the area, the deep well is properly constructed and the Mt. Simon aquifer is an appropriate formation, future remedial action is not anticipated. This option does not preclude future remedial action at the site. While migration or exposure pathways close to the surface may be readily monitored, monitoring of the injection zone to determine whether the material is confined, may prove difficult. Failure to detect problems may result in contamination of another aquifer. No difficulties are foreseen in long-term operation and maintenance.	Extraction well, deep well and cap installers with related equipment should be available.	The need for a Petition Demonstration may delay implementation of this project. Because the regulations governing underground injection wells are in a state of flux, it is impossible at this time to determine agency response. If an adequate Petition Demonstration can be prepared for USEPA, the alternative should be able to obtain approval from other agencies. Some community response may be received in regard to treatment by injection rather than conventional techniques. Due to the large number of CERCLA sites in the area, other sites may benefit from the implementation of this alternative.

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IMPLEMENTABILITY EVALUATION OF ALTERNATIVES

	TECHNICAL FEASIBILITY SHORT TERM	TECHNICAL FEASIBILITY LONG TERM	AVAILABILITY	ADMINISTRATIVE FEASIBILITY
Alternative 4B	It is expected that all location and action-specific requirements can be achieved. Based on past performance, technologies should be capable of providing process efficiencies to remove F001 to F005 solvents to the required level before deep well injection. Air stripping and granular activated carbon are widely used conventional technologies that should encounter no difficulties during construction.	With adequate operation and maintenance, technologies should continue to provide the necessary process efficiencies. Assuming that the extraction wells are properly placed to influence the area, the deep well is properly constructed and the Mt. Simon aquifer is an appropriate formation, future remedial action is not anticipated. This option does not preclude future remedial action at the site. While migration or exposure pathways close to the surface may be readily monitored, monitoring of the injection zone to determine whether the material is confined, may prove difficult. Failure to detect problems may result in contamination of another aquifer. No difficulties are foreseen in long-term operation and maintenance. Regulations are in a state of flux. Additional restrictions on hazardous compounds may require additional treatment.	Extraction well, deep well, cap and process unit installers with related equipment as well as all process units themselves should be available. Disposal/recycle facilities for the spent carbon are limited to four facilities but should not prevent implementation.	Approval for the deep well must be obtained. Because the regulations governing underground injection wells are in a state of flux, it is impossible at this time to determine agency response. Some community response may be received in regard to treatment by injection rather than conventional techniques. Due to the large number of CERCLA sites in the area, other sites may benefit from the implementation of this alternative. Alternative may be more likely to be approved by agencies, since no Petition Demonstration is necessary.
Alternative 4C	It is expected that all location and action-specific requirements can be achieved. Based on past performance, technologies should be capable of providing process efficiencies to remove contaminants to drinking water quality except salinity. Air stripping, cyanide oxidation, metals precipitation, and carbon adsorption are widely used conventional technologies that should encounter little difficulty during construction.	With adequate operation and maintenance, technologies should continue to provide the necessary process efficiencies. Assuming that the extraction wells are properly placed to influence the area, the deep well is properly constructed and the Mt. Simon aquifer is an appropriate formation, future remedial action is not anticipated. This option does not preclude future remedial action at the site. While migration or exposure pathways close to the surface may be readily monitored, monitoring of the injection zone to determine whether the material is confined, may prove difficult. Failure to detect problems may result in contamination of another aquifer. No difficulties are foreseen in long-term operation and maintenance. Regulations are in a state of flux. Additional restrictions on hazardous compounds may require additional treatment.	Extraction well, deep well, cap and process unit installers with related equipment as well as all process units themselves should be available. Adequate capacity in appropriate landfill should be available for metals sludge. Disposal/recycle facilities for the spent carbon are limited to four facilities but should not prevent implementation.	Approval for the deep well must be obtained. Because the regulations governing underground injection wells are in a state of flux, it is impossible at this time to determine agency response. Some community response may be received in regard to treatment by injection rather than conventional techniques. Due to the large number of CERCLA sites in the area, other sites may benefit from the implementation of this alternative. Alternative may be more likely to be approved by agencies, since no Petition Demonstration is necessary and the water is being treated to ground water quality except salinity.

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IMPLEMENTABILITY EVALUATION OF ALTERNATIVES

	TECHNICAL FEASIBILITY SHORT TERM	TECHNICAL FEASIBILITY LONG TERM	AVAILABILITY	ADMINISTRATIVE FEASIBILITY
Alternative 4F	It is expected that all location and action-specific requirements can be achieved. Evaporation/crystallization is capable of providing process efficiencies to remove the liquid portion of the extract, allowing for disposal of the remaining solids. Evaporation by itself may not provide a condensate that is clean enough for discharge or shallow aquifer injection. Disposal of salt crystals may be limited by the amount of free cyanide present and could significantly increase the cost of this alternative. Evaporation is a widely used conventional technology that should encounter little difficulty during construction.	With adequate operation and maintenance, evaporation/crystallization should provide necessary treatment over the long term. No difficulties are foreseen in long-term operation and maintenance. Future remedial action is not anticipated. This option does not preclude future remedial action at the site. Monitoring of the site for effectiveness should be no problem.	Extraction well, cap and process unit installers with related equipment as wel as the evaporation/crystallization process units themselves should be available. Landfill capacity is limited, but should be available. Distances to off-site landfill facilities are long.	Evaporation of extracted ground water should result in a favorable response from other agencies.
Alternative 5A	The difficulties related with excavation concern the control of the material. Adequate health and safety provisions must be implemented.	No likely future remedial action is anticipated. Migration or exposure pathways can be adequately monitored. No additional risk of exposure exists, should monitoring fail, as material has been removed from the site. Source control measures have demonstrated performance. Site operation and maintenance are minimal.	Use available hazardous waste landfill capacity for disposal of material is limited. Distances to off-site landfill facilities are long and transport would be expensive.	Alternative may not be approvable since ground water contamination will not be remediated. Enforcement of ground water use restrictions may be very difficult. Due to the problems of transportation, community response may not be favorable.
Alternative 5C	It is expected that there will be little difficulty with construction. Procedure similar to RCRA delisting may delay project schedule.	No likely future remedial actions are anticipated. The solidified ash may present problems with future remedial actions. The continued effectiveness should be easily monitored. Maintenance of site is minimal, involving inspection, mowing, erosion protection, and access restriction.	Adequate vapor extraction and incineration equipment and disposal should be available. Necessary operating personnel should be available.	It is expected that this alternative may not be approved by other agencies and the community since ground water contamination will not be remediated. Enforcement of ground water use restrictions may be very difficult. The construction of an on-site incinerator has been known to cause public opposition. Due to the closeness of residences, the implementability is unknown.

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IMPLEMENTABILITY EVALUATION OF ALTERNATIVES

	TECHNICAL FEASIBILITY SHORT TERM	TECHNICAL FEASIBILITY LONG TERM	AVAILABILITY	ADMINISTRATIVE FEASIBILITY
Alternative 5E	If proper treatability tests are conducted, it is expected that there will be no difficulty with construction. However, this type of solidification is considered innovative for this large mix of organic and inorganic wastes. Procedures similar to RCRA delisting may delay project schedule.	No likely future remedial actions are anticipated. The solidified material may present problems with future remedial actions. The continued effectiveness of this remedy should be easily monitored. Maintenance of site is minimal, involving inspection, mowing, erosion protection, and access restriction.	Adequate treatment and disposal services should be available. Necessary equipment and specialists should be available, assuming the material is readily solidified and can conform to procedures similar to RCRA delisting.	It is expected that this alternative may not be approved by other agencies and the community since ground water contamination will not be remediated. Enforcement of ground water use restrictions may be very difficult. Unfavorable response may also relate to limiting use of the property by forming a cemented solid.
Alternative 5G	Difficulties during construction may be encountered due to the high ground water table and type of soil. This alternative has been demonstrated during pilot testing; however, the technology has not been proven on a full scale project. Therefore, the alternative should be considered innovative. No excavation of site material would be necessary, thus reducing the workers' exposure to material. Large amounts of electricity are required to operate this type of system. Air pollution controls must be provided to treat off-gases. Equipment must be custom fabricated and assembled. Personnel must be highly skilled. Effects on areas surrounding the melt are uncertain.	It is not anticipated that future remedial action would be needed. This option would preclude some types of remedial action due to the creation of the solid monolith. Area around the source area should be easily and readily monitored and maintained.	At the present time, the necessary equipment and specialists to perform large-scale in-situ vitrification are not available. This may increase the implementation period to an unacceptable level.	Due to the large number of unknowns associated with this innovative treatment, the likelihood of unfavorable community response is increased. Alternative may not be approvable since ground water contamination will not be remediated. Enforcement of ground water use restrictions may be very difficult.
Alternative 6	Same as Alternatives 3 and 5E. The difficulty of performing two types of remediation on site at one time could delay the construction schedule.	Same as Alternatives 3 and 5E.	Same as Alternatives 3 and 5E.	Same as Alternatives 3 and 5E. Although ground water contamination will not be remediated to cleanup action levels, all the risks are eliminated by preventing contact with contaminated soil and ground water. Due to high level of protection, response will likely be favorable.
Alternative 7	Same as Alternatives 4A and 5E. The difficulty of performing two types of remediation on site at one time could delay the construction schedule.	Same as Alternatives 4A and 5E.	Same as Alternatives 4A and 5E.	Same as Alternatives 4A and 5E. Ground water contamination will be remediated to cleanup action levels. Due to the high level of protection, response will likely be favorable.
Alternative 8	Same as Alternatives 4C and 5E. The difficulty of performing two types of remediation on site at one time could delay the construction schedule.	Same as Alternatives 4C and 5E.	Same as Alternatives 4C and 5E.	Same as Alternatives 4C and 5E. Ground water contamination will be remediated to cleanup action levels. Due to the high level of protection, response will likely be favorable.
Alternative 9	Same as Alternatives 4E and 5E. The difficulty of performing two types of remediation on site at one time could delay the construction schedule.	Same as Alternatives 4E and 5E.	Same as Alternatives 4E and 5E.	Same as Alternatives 4E and 5E. Ground water contamination will be remediated to cleanup action levels. Due to the high level of protection, response will likely be favorable.

TABLE 4-20

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DETAILED ANALYSIS SUMMARY

	EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 1	-- Does not reduce potential public health risk associated with contaminated soils if excavated and exposed or ground water if ingested. Increased lifetime cancer risk to future on-site residents (1.6 x 10^{-2}) is unacceptable. Toxicity, mobility, or volume of contaminants in soil and ground water are not permanently or significantly reduced.	-- No remedial action is taken with this alternative. It is extremely likely that future remedial action will be required. It is extremely unlikely that this alternative would receive the necessary approvals from any agency or from the community. Location and chemical-specific requirements would not be met.	Total Capital = 0 Annual O&M = 0 Present Worth = 0
Alternative 2	-- Final protection from exposure to on-site contamination is achieved upon completion of cap construction, approximately 1 year after initiation of construction. Cleanup action levels (CALs) for soil and ground water will not be met as soil remains without treatment and ground water that has migrated off site will not be treated. Continued potential for ground water degradation exists due to lateral ground water migration. Surface water contaminants may be worsened by continual discharge of contaminated ground water. Performance of properly installed multi-layered cap is generally good for first 20 years of service. Without ground water use restrictions, the remaining risk at the site after remediation completion would be 1.6 x 10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels. Reduces mobility of contaminants in soil but does not significantly or permanently reduce toxicity or volume or reduce the mobility of contaminants that are already in the ground water.	o Technologies can be constructed as needed for specific site. It is probable that future remedial action would be required if contaminants move off site with the ground water. The cap installers should be readily available. It is unlikely that the community response to this alternative will be favorable, as contaminants may continue to leave the site. While most location-specific requirements may be met, chemical-specific requirements will not. Enforcement of ground water use restrictions may be very difficult.	Total Capital = 2,641,000 Annual O&M = 232,000 Present Worth = 4,788,000
Alternative 3	+ Safety concern during installation related to excavation activities. Protection against principle threat can be achieved upon completion of construction, approximately 1 to 2 years. Cleanup action levels (CALs) for soil and ground water will not be met because no treatment is provided for them. Eliminates direct contact exposure to contaminants. Contamination may move vertically to next aquifer. This aquifer has very little yield, and is not used for drinking water purposes. High salt and organic concentrations may effect permeability of wall. After remediation is completed, all risks are reduced below acceptable levels. Significantly reduces mobility of contaminants in soil and ground water, but does not reduce toxicity or volume.	+ It is expected that with proper bench-scale testing and installation, technology will be capable of meeting performance specifications. Action-specific requirements will be met. Difficulties with long-term O&M may arise from action of the contaminants, especially the salt and organics, on the wall itself. Containment walls are a demonstrated technology that are readily available and easy to construct. A condition of the acceptance would include deed and access restrictions, as well as careful monitoring to ensure the waste is not moving through to the next aquifer.	Total Capital = 5,832,000 Annual O&M = 232,000 Present Worth = 7,978,000
Alternative 4A	+ Remedial action activities will not commence for 1 to 2 years, as a Petition Demonstration for deep well must be approved by EPA. Construction of remedial action should take 2 years. Cleanup action levels (CALs) for soil will not be met as soil remains without treatment. The ground water that has migrated off site will be removed where CALs are exceeded and ground water CALs on site would be met. After remediation is completed, if deed restrictions and site maintenance are performed, all risks are reduced below acceptable levels. Significantly and permanently reduces the mobility of contaminants in the soil but does not reduce toxicity or volume of some contaminants in soil. Significantly and permanently reduces mobility of contaminants in ground water.	o It is expected that the biggest difficulty with the option will be in obtaining approval of the Petition Demonstration. Failure to detect problems may result in contamination of another aquifer. Extraction well, deep well and cap installers with related equipment should be available. Because the regulations governing underground injection wells are in a state of flux, it is impossible at this time to determine agency response. Due to the large number of CERCLA sites in the area, other sites may benefit from the implementation of this alternative.	Total Capital = 4,110,000 Annual O&M = 301,000 Present Worth = 6,884,000

TABLE 4-20

MIDCO II

DETAILED ANALYSIS SUMMARY

	EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 4B	• Remedial action activities may not commence for at least 1 year, as approval for this option must be obtained. Construction of remedial action should take 2 years. Cleanup action levels (CALs) for soil will not be met as soil remains without treatment. The ground water that has migrated off site will be removed where CALs are exceeded and ground water CALs on site would be met. After remediation is completed, if deed restrictions and site maintenance are performed, all risks are reduced below acceptable levels. Significantly and permanently reduces the mobility of contaminants in the soil but does not reduce toxicity or volume of some contaminants in soil. Significantly and permanently reduces mobility and toxicity of contaminants in ground water but does not reduce volume. Some contaminants in ground water are transferred to carbon canisters which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.	• It is expected that all location and action-specific requirements can be achieved. With adequate operation and maintenance, technologies should continue to provide the necessary process efficiencies. Failure to detect problems may result in contamination of another aquifer. Extraction well, deep well, cap and process unit installers with related equipment as well as all process units themselves should be available. Disposal/recycle facilities for the spent carbon are limited. Because the regulations governing underground injection wells are in a state of flux, it is impossible at this time to determine agency response. Alternative may be more likely to be approved by agencies, since no Petition Demonstration is necessary.	Total Capital : 3,836,000 Annual O&M : 675,000 Present Worth :10,133,000
Alternative 4C	• Approval for this option should not unduly slow action down as contaminants will be removed to drinking water quality except salinity before injection. Construction of remedial action should take 2 years. Cleanup action levels (CALs) for soil will not be met as soil remains without treatment. The ground water that has migrated off site will be removed where CALs are exceeded and ground water CALs on site would be met. The level of acetone being injected into the deep well will exceed the CAL. No MCL or MCLG presently exists for acetone. After remediation is completed, if deed restrictions and site maintenance are performed, all risks are reduced below acceptable levels. Significantly and permanently reduces the mobility of contaminants in soil but does not reduce toxicity or volume of some contaminants in soil. Significantly and permanently reduces mobility and toxicity of contaminants in ground water but does not reduce volume. Some contaminants in ground water are transferred to carbon canisters and metals sludges which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.	• It is expected that all location and action-specific requirements can be achieved. With adequate operation and maintenance, technologies should continue to provide the necessary process efficiencies. Failure to detect problems may result in contamination of another aquifer. Extraction well, deep well, cap and process unit installers with related equipment as well as all process units themselves should be available. Adequate capacity in appropriate landfill should be available for metals sludge. Disposal/recycle facilities for the spent carbon are limited. Because the regulations governing underground injection wells are in a state of flux, it is impossible at this time to determine agency response. Alternative may be more likely to be approved by agencies, since no Petition Demonstration is necessary and the water is being treated to ground water quality except salinity.	Total Capital : 4,277,000 Annual O&M : 733,000 Present Worth :11,119,000

TABLE 4-20

MIDCO II

DETAILED ANALYSIS SUMMARY

	EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 4I	+ Approval for the evaporator system should be readily obtainable as this is conventional technology. Construction of remedial action should take 1 to 2 years. Cleanup action levels (CALs) for soil will not be met as soil remains without treatment. The ground water that has migrated off site will be removed where CALs are exceeded and ground water CALs on site would be met. After remediation is completed, if deed restrictions and site maintenance are performed, all risks are reduced below acceptable levels. Significantly and permanently reduces the mobility of contaminants in the soil but does not reduce toxicity or volume of some contaminants in soil. Significantly and permanently reduces mobility and toxicity of contaminants in ground water but does not reduce volume. Some contaminants in ground water are transferred to salt crystals which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.	+ It is expected that all location and action-specific requirements can be achieved. With adequate operation and maintenance, evaporation/crystallization should provide necessary treatment over the long term. Evaporation by itself may not provide a condensate that is clean enough for discharge or shallow aquifer injection. Extraction well, cap and process unit installers with related equipment as well as the evaporation/crystallization process units themselves should be available. Landfill capacity is limited, but should be available. Distances to off-site landfill facilities are long. Disposal of salt crystals may be limited by the amount of free cyanide present and could significantly increase the cost of the alternative. Evaporation of extracted ground water should result in a favorable response from other agencies.	Total Capital : 2,996,000 Annual O&M : 1,044,000 Present Worth :12,800,000
Alternative 5A	- Safety concerns during the remedial action are related to the excavation of the material. Cleanup action levels for soils above ground water level would be met. CALs for soils below ground water may not be met; however, risk calculations are based on ingestion of soil, and these additional solids would be below the water table and unavailable for ingestion. Attenuation results in a dissipation of contaminants, although it will be many years before ground water cleanup action levels will be attained for all compounds. Without ground water use restrictions, the remaining risk at the site after remediation completion would be 1.6×10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels. Reduces volume of contaminants in soil by removing it from site but transfers the problem to the landfill site. Does not reduce volume, mobility or toxicity of contaminants in ground water.	-- The difficulties related with excavation concern the control of the material. The available hazardous waste landfill capacity for disposal of material is limited. Distances to off-site landfill facilities are long and transport would be expensive. Alternative may not be approvable since off-site ground water contamination will not be remediated. Enforcement of ground water use restrictions may be very difficult. Due to the problems of transportation, community response may not be favorable.	Total Capital :18,007,000 Annual O&M = 232,000 Present Worth :20,155,000
Alternative 5C	- Safety concerns during the remedial action are related to the excavation of the material. Extensive requirements including trial burn plus IDEM backlog could delay the the start of remediation up to 2 years. Completion of the construction should be less than 1 year. The actual soil remediation should be less than 1 year. Cleanup action levels for soils above ground water would be met. CALs for soils below ground water may not be met; however, risk calculations are based on ingestion of soil, and these additional solids would be below the water table and unavailable for ingestion. Attenuation results in a dissipation of contaminants, although it will be many years before ground water cleanup action levels will be attained for all compounds. Without ground water use restrictions, the remaining risk at the site after remediation completion would be 1.6×10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels. Significantly and permanently reduces toxicity and mobility of contaminants in soil but does not reduce toxicity, mobility, or volume of contaminants in ground water.	- It is expected that this alternative may not be approved by other agencies and the community since ground water contamination will not be remediated. Enforcement of ground water restrictions may be very difficult. The construction of an on-site incinerator has been known to cause public opposition. Due to the closeness of residences, the implementability is unknown. Necessary equipment and disposal services as well as operating personnel should be available. Procedures similar to RCRA delisting may delay project schedule.	Total Capital :26,400,000 Annual O&M : 232,000 Present Worth :28,627,000

TABLE 4-20

MEDIA II

DETAILED ANALYSIS SUMMARY

	EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative SF	Safety concern during installation associated with excavation and mixing of contaminated material. It will be necessary to perform treatability studies to adequately demonstrate that the solidified waste can conform to procedures similar to RCRA delisting. This may delay initiation of construction. Completion of construction should be 1 year. Cleanup action levels for soils above ground water level would be met. CALs for soils below ground water may not be met; however, risk calculations are based on ingestion of soil, and these additional solids would be below the water table and unavailable for ingestion. Attenuation results in a dissipation of contaminants, although it will be many years before ground water cleanup action levels will be attained for all compounds. Without ground water use restrictions, the remaining risk at the site after remediation completion would be 1.6×10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels. Significantly and permanently reduces mobility of contaminants in soil, but does not reduce toxicity, mobility or volume of contaminants in ground water.	This type of solidification is considered innovative for this large mix of organic and inorganic wastes. Procedures similar to RCRA delisting may delay project schedule. Adequate treatment and disposal services should be available. It is expected that this alternative may not be approved by other agencies and the community since off-site ground water contamination will not be remediated. Enforcement of ground water use restrictions may be very difficult. Unfavorable response may also relate to limiting use of the property by forming a cemented solid.	Total Capital =11,766,000 Annual O&M = 232,000 Present Worth =13,[illegible],000
Alternative SG	Because no excavation of material occurs and all of the materials are treated in a hood, risk is minimized. Completion of construction should be 1 to 2 years. Cleanup action levels for soils above ground water level would be met. CALs for soils below ground water may not be met; however, risk calculations are based on ingestion of soil, and these additional solids would be below the water table and unavailable for ingestion. Attenuation results in a dissipation of contaminants, although it will be many years before ground water cleanup action levels will be attained for all compounds. Technology has not been proven on full scale project. Without ground water use restrictions, the remaining risk at the site after remediation completion is 1.6×10^{-2}. With enforcement of ground water use restrictions, all risks would be reduced below acceptable levels. Significantly and permanently reduces toxicity, mobility and volume of contaminants in soil, but does not reduce toxicity, mobility, or volume of contaminants in ground water.	This alternative has been demonstrated during pilot testing; however, effects on areas surrounding the melt are unknown. The technology has not been proven on a full scale project. At the present time, the necessary equipment and specialists to perform large-scale in-situ vitrification are not available. Due to the large number of unknowns associated with this innovative treatment, the likelihood of unfavorable community response is increased. Alternative may not be approvable since off-site ground water contamination will not be remediated. Enforcement of ground water use restrictions may be very difficult.	Total Capital =18,484,000 Annual O&M = 232,000 Present Worth =20,632,000

TABLE 4-20

MIDCO II

DETAILED ANALYSIS SUMMARY

	EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 6	+ It will be necessary to perform treatability studies to demonstrate that the solidified waste can conform to procedures similar to RCRA delisting. This may delay construction initiation. Construction of remedial action would take 1 to 2 years. Combines the long-term effectiveness of Alternatives 3 and 5C. Cleanup action levels for soil above ground water will be met. CALs for soil below ground water may not be met; however, risk calculations are based on ingestion of soil, and this would be unavailable for ingestion. Ground water cleanup action levels would not be met on site. After remediation is completed, all risks are reduced below acceptable levels. Significantly and permanently reduces mobility of contaminants in soil and ground water.	+ Same as Alternatives 3 and 5C. The difficulty of performing two types of remediation on site at one time could delay the construction schedule. Although ground water contamination will not be remediated to cleanup action levels, all the risks are eliminated by preventing contact with contaminated soil and ground water. Due to the high level of protection, response will likely be favorable.	Total Capital :16,779,000 Annual O&M : 227,000 Present Worth :18,886,000
Alternative 7	++ Remedial action activities for ground water may not commence for 1 to 2 years as a Petition Demonstration for the deep well must be approved. It will be necessary to perform treatability studies to demonstrate that the solidified waste can conform to procedures similar to RCRA delisting. This may delay construction initiation. Construction of the remedial action would take approximately 2 years. Combines the long-term effectiveness of Alternatives 4A and 5C. Cleanup action levels for soil above ground water will be met. CALs for soil below ground water may not be met; however, risk calculations are based on ingestion of soil, and this would be unavailable for ingestion. Ground water cleanup action levels would be met. After remediation is completed, all risks are reduced below acceptable levels. Permanently and significantly reduces mobility of contaminants in soil and ground water.	0 Same as Alternatives 4A and 5C. The difficulty of performing two types of remediation on site at one time could delay the construction schedule. Due to the high level of protection, response will likely be favorable.	Total Capital :14,730,000 Annual O&M : 301,000 Present Worth :17,504,000
Alternative 8	++ Approval for this option should not unduly slow action down as contaminants will be removed to drinking water quality except salinity before injection. It will be necessary to perform treatability studies to demonstrate that the solidified waste can conform to procedures similar to RCRA delisting. This may construction initiation. Construction of remedial action would take 2 years. Combines the long-term effectiveness of Alternatives 4C and 5C. Cleanup action levels for soil above ground water will be met. CALs for soil below ground water may not be met; however, risk calculations are based on ingestion of soil, and this would be unavailable for ingestion. Ground water cleanup action levels would be met. If water leaves deep aquifer, since this is not a drinking water aquifer, the increased salinity should not pose a problem. After remediation is completed, all risks are reduced below acceptable levels. Significantly and permanently reduces mobility of contaminants in soil and mobility and toxicity of contaminants in ground water. Some contaminants in ground water are transferred to carbon canisters and metals sludges which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.	+ Same as Alternatives 4C and 5C. The difficulty of performing two types of remediation on site at one time could delay the construction schedule. Due to the high level of protection, response will likely be favorable.	Total Capital :14,899,000 Annual O&M : 733,000 Present Worth :21,740,000

TABLE 4-20

MIDCO II

DETAILED ANALYSIS SUMMARY

	EFFECTIVENESS	IMPLEMENTABILITY	COST
Alternative 9	++ Approval for the evaporator system should be readily obtainable as this is conventional technology. It will be necessary to perform a treatability study to demonstrate that the solidified waste can conform to procedures similar to RCRA delisting. This may delay construction initiation. Construction of remedial action should take 1 to 2 years. Combines the long-term effectiveness of Alternatives 4E and 5E. Cleanup action levels for soil above ground water will be met. CALs for soil below ground water may not be met; however, risk calculations are based on ingestion of soil, and this would be unavailable for ingestion. Ground water cleanup action levels would be met. After remediation is completed, all risks are reduced below acceptable levels. Significantly and permanently reduces mobility of contaminants in soil and mobility, toxicity, and volume of contaminants in ground water. Some contaminants in ground water are transferred to salt crystals which are disposed of off site. Does not significantly or permanently reduce toxicity or mobility of these residuals.	+ Same as Alternatives 4E and 5E. The difficulty of performing two types of remediation on site at one time could delay the construction schedule. Due to the high level of protection, response will likely be favorable.	Total Capital =13,803,000 Annual O&M = 1,066,000 Present Worth =23,607,000

Ratings:
++ : Extremely positive
+ : Positive or moderately positive
0 : Very little effect or no change from existing condition
- : Negative effect of moderate significance
-- : Extremely negative

MIDCO II

TABLE 13

ESTIMATED COSTS IN MILLIONS OF DOLLARS AND TIME TO IMPLEMENT

ALTERNATIVE	PRESENT WORTH	CAPITAL COST	ANNUAL O&M COST	YEARS TO PERMIT AND CONSTRUCT	YEARS TO COMPLETE ACTION
1. No Action	0	0	0	0	0
2. Cap	4.8	2.6	0.23	2	1
3. Containment	7.9	5.8	0.23	3	2
REMEDIES THAT DIRECTLY ADDRESS GROUNDWATER					
4A. Deep Well	6.9	4.1	0.30	4	30
4C. Treat and[1] Deep Well	11.1	4.3	0.73	3	30
4E. Evaporation	12.8	3.0	1.0	3	30
REMEDIES THAT DIRECTLY ADDRESS SOURCE					
5A. Landfill	17.5	15.4	0.23	2	2
5C. Incineration	26.0	23.9	0.23	4	4
5E. Solidification	11.3	9.1	0.23	2	2
5G. Vitrification	20.6	18.5	0.23	3	3
REMEDIES THAT DIRECTLY ADDRESS SOURCE AND GROUNDWATER					
6. Combines 5E with 3	16.3	14.2	0.23	3	3
7. Combines 5E with 4A	14.4	11.6	0.30	4	30
8. Combines 5E[1] with 4C	18.6	11.8	0.73	4	30
9. Combines 5E with 4E	21.0	11.2	1.04	4	30

1. Costs based on treatment to drinking water standards prior to deep well injection. For treatment only to Land Disposal Restriction Treatment standards, cost estimate is $1,000,000 less.

MIDCO II

TABLE OF EFFECTIVENESS AND IMPLEMENTABILITY

Alternative	Will Contaminants Migrate Off-site in Ground Water?	Will Action Result in Non-compliance with State or Federal Standards?	Will Contaminants of Potential Health Concern Remain in the Soil or Ground Water?	Will a Significant Amount of Off-site Hazardous Waste Disposal Occur?	Are Significant Implementation Problems Expected?
1. No Action	Yes	Yes	Yes	No	Yes[4]
2. Cap	Yes	Yes	Yes	No	Yes[4]
3. Containment	No	No	Yes	No	No[5]
REMEDIES THAT DIRECTLY ADDRESS GROUNDWATER					
4A. Deep Well	No	No	Yes	No[1]	No[6]
4C. Treat and Deep Well	No	No	Yes	No[2]	No
4E. Evaporation	No	No	Yes	Yes[3 8]	No
REMEDIES THAT DIRECTLY ADDRESS SOURCE					
5A. Landfill	Yes	Yes	Yes	Yes	Yes[8]
5C. Incineration	Yes	Yes	Yes	No	Yes
5E. Solidification	Yes	Yes	Yes	No	Yes
5G. Vitrification	Yes	Yes	Yes	No	Yes[7]

REMEDIES THAT DIRECTLY ADDRESS SOURCE AND GROUNDWATER

6. (5E + 3)	No	No	Yes	No	No
7. (5E + 4A)	No	No	No	No[1]	No[7]
8. (5E + 4C)	No	No	No	No[2]	No
9. (5E + 4E)	No	No	No	Yes[3] [8]	No

[1] Hazardous Waste Disposal in Deep Aquifer.

[2] Small amounts of precipitated metals and spent carbon may be landfilled.

[3] Salt cake contaminated with metals, cyanide and some organics will be landfilled. Organic liquids will be incinerated.

[4] Approval under CERCLA is unlikely.

[5] The long term effectiveness of the slurry wall is uncertain.

[6] May be problems obtaining approval for deep well injection.

[7] Procedures are not proven in a full scale project. High water table may cause difficulties during contruction.

[8] Land Disposal Restrictions may not allow.

TABLE 4-15

ALTERNATIVE 7
GROUND WATER PUMPING AND DEEP WELL INJECTION WITH IN-SITU VAPOR EXTRACTION AND SOLIDIFICATION ABOVE GROUND WATER ELEVATION
COST ESTIMATE *

Site/Process Preparation	$ 17,596	
Soil/Sediment Handling/Treatment	~~6,202,000~~	4,417,000
Ground Water Handling/Treatment	1,730,400	
Site Restoration	199,500	
Access Restriction	33,600	
Monitoring System	252,500	
CONSTRUCTION SUBTOTAL	~~$8,435,596~~	6,651,000
Contingencies	~~3,374,238~~	2,660,400
CONSTRUCTION TOTAL	~~$11,809,834~~	9,311,400
Permitting	~~170,000~~	137,000
Services During Construction	~~1,300,000~~	1,025,000
Delisting	150,000	
Engineering	~~1,300,000~~	1,025,000
TOTAL CAPITAL COST	~~$14,730,000~~	11,648,400
ANNUAL OPERATION AND MAINTENANCE	$ 301,000	
TOTAL PRESENT WORTH (10% discount rate, 30-year life)	~~$17,504,000~~	14,419,000

See Appendix D for detailed cost information

* From Table 4-15 of FS with costs for the soil vapor extraction system subtracted.

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TABLE 4-16

ALTERNATIVE 8
GROUND WATER PUMPING, GROUND WATER TREATMENT TO DRINKING WATER QUALITY EXCEPT ** SALINITY, AND DEEP WELL INJECTION WITH IN-SITU VAPOR EXTRACTION AND SOLIDIFICATION ABOVE GROUND WATER ELEVATION COST ESTIMATE *

Site/Process Preparation	$ 17,596	
Soil/Sediment Handling/Treatment	~~6,202,000~~	4,417,300
Ground Water Handling	1,230,400	
Ground Water Treatment	535,000	
Site Restoration	199,500	
Access Restriction	33,600	
Monitoring System	252,500	
CONSTRUCTION SUBTOTAL	~~$8,470,596~~	6,665,600
Contingencies	~~3,388,238~~	2,666,200
CONSTRUCTION TOTAL	~~$11,858,834~~	9,331,800
Permitting	~~190,000~~	149,500
Services During Construction	~~1,350,000~~	1,062,300
Delisting	150,000	
Engineering	~~1,350,000~~	1,062,500
TOTAL CAPITAL COST	~~$14,899,000~~	11,755,400
ANNUAL OPERATION AND MAINTENANCE	$ 733,000	
TOTAL PRESENT WORTH (10% discount rate, 30-year life)	~~$21,740,000~~	18,596,400

See Appendix D for detailed cost information

* From Table 4-16 of FS with costs for soil vapor extraction subtracted.

** Costs are estimated to be $1,000,000 less for treatment only to Land Disposal Restriction Treatment standards.

Table 17

TABLE 1 (PAGE 1 OF 2)
MIDCO II
GROUND WATER CLEANUP ACTION LEVELS

Compound	Detection Limit * (ug/l)	Cleanup Action Level (ug/l)	Basis
Arsenic		15.1	Ground water background concentration (95% UCL).
Barium	200	107	Ground water background concentration (95% UCL).
Beryllium	5	1.0	Noncarcinogenic risk from the site (all media) < 1.
Cadmium	5	0.25	Noncarcinogenic risk from the site (all media) < 1.
Chromium	10	7.5	Ground water background concentration (95% UCL).
Copper		119	Chronic Water Quality Criteria for the protection of freshwater life, with a dilution factor of 3.57 (from Midco II Remedial Investigation Report), lowest detected hardness.
Iron		15,300	Ground water background concentration (95% UCL).
Lead		50	Maximum Contaminant Level.
Manganese		464	Ground water background concentration (95% UCL).
Mercury		0.25	Ground water background concentration (95% UCL).
Nickel	40	12.3	Ground water background concentration (95% UCL).
Selenium	5	1.5	Noncarcinogenic risk from the site (all media) < 1.
Silver	10	0.43	Chronic Water Quality Criteria for the protection of freshwater life, with a dilution factor of 3.57.
Thallium	10	0.0349	Noncarcinogenic risk from the site (all media) < 1.
Vanadium	50	3.49	Noncarcinogenic risk from the site (all media) < 1.
Zinc		1,470	Ground water background concentration (95% UCL).
Cyanide		158	Ground water background concentration (95% UCL).
Vinyl chloride		2.2	Ground water background concentration (95% UCL).
Chloroethane		10	Ground water background detection limit.
Methylene chloride	5	1.9	Ground water background concentration (95% UCL).
Acetone		12.8	Noncarcinogenic risk from the site (all media) < 1.
1,1-Dichloroethene	1.3	0.000208	Carcinogenic risk from the site (all media) < 1 E-06.
1,1-Dichloroethane	0.7	0.00932	Carcinogenic risk from the site (all media) < 1 E-06.
Trans-1,2-dichloroethene		70	Maximum Contaminant Level Goal (proposed).
2-Butanone	10	9.57	Noncarcinogenic risk from the site (all media) < 1.
1,1,1-Trichloroethane		24	Noncarcinogenic risk from the site (all media) < 1.
1,2-Dichloropropane	0.4	0.0125	Carcinogenic risk from the site (all media) < 1 E-06.
Trichloroethene	1.2	0.0174	Carcinogenic risk from the site (all media) < 1 E-06.
Benzene	2	0.04	Ground water background concentration (95% UCL).
4-Methyl-2-Pentanone	10	3.03	Noncarcinogenic risk from the site (all media) < 1.
Tetrachloroethene	0.3	0.014	Carcinogenic risk from the site (all media) < 1 E-06.
Toluene		80.1	Noncarcinogenic risk from the site (all media) < 1.
Ethylbenzene		12.8	Noncarcinogenic risk from the site (all media) < 1.
Xylenes		64.5	Noncarcinogenic risk from the site (all media) < 1.
Phenol		5.13	Noncarcinogenic risk from the site (all media) < 1.

TABLE 1 (PAGE 2 OF 2)

Compound	Detection Limit * (ug/l)	Cleanup Action Level (ug/l)	Basis
Bis(2-chloroethyl)ether	10	0.000198	Carcinogenic risk from the site (all media) < 1 E-06.
Bis(2-chloroisopropyl)ether		10	Ground water background detection limit.
Cresol	10	6.41	Noncarcinogenic risk from the site (all media) < 1.
Isophorone	10	0.207	Carcinogenic risk from the site (all media) < 1 E-06.
2,4-Dimethylphenol		10	Ground water background detection limit.
Benzoic Acid		58.7	Noncarcinogenic risk from the site (all media) < 1.
Bis(2-Chloroethoxy)methane		10	Ground water background detection limit.
2,4-Dichlorophenol	3.9	0.163	Noncarcinogenic risk from the site (all media) < 1.
Naphthalene		21	Noncarcinogenic risk from the site (all media) < 1.
2-Methylnaphthalene		10	Ground water background detection limit.
Acenaphthene		10	Ground water background detection limit.
4-Nitrophenol		50	Ground water background detection limit.
2,4-Dinitrotoluene	10	0.000213	Carcinogenic risk from the site (all media) < 1 E-06.
Diethylphthalate	4.9	1.25	Noncarcinogenic risk from the site (all media) < 1.
Fluorene		10	Ground water background detection limit.
4-Nitroaniline		50	Ground water background detection limit.
Phenanthrene		10	Ground water background detection limit.
Di-n-Butylphthalate		9.44	Noncarcinogenic risk from the site (all media) < 1.
Bis(2-ethylhexyl)phthalate	10	0.0606	Carcinogenic risk from the site (all media) < 1 E-06.
Di-n-Octylphthalate		10	Ground water background detection limit.
Heptachlor epoxide	0.05	0.000326	Carcinogenic risk from the site (all media) < 1 E-06.

* Practical quantitation limits as per USEPA "Test Methods for Evaluating Solid Waste," 3rd Edition, SW-846, Nov. 1986. Values shown are higher than the corresponding cleanup action levels. Therefore, the actual cleanup action level for each of these compounds is "nondetectable."

UCL: Upper confidence limit of the average concentration (from Midco II Remedial Investigation).

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TABLE 2 (PAGE 1 OF 2)
MIDCO II
SOIL CLEANUP ACTION LEVELS

Compound	Detection Limit * (ug/kg)	Cleanup Action Levels (ug/kg)	Basis
Antimony		2,870	Noncarcinogenic risk from the site (all media) < 1.
Arsenic		14,000	Surface soil background concentration (95% UCL).
Barium		169,000	Noncarcinogenic risk from the site (all media) < 1.
Beryllium		2,930	Noncarcinogenic risk from the site (all media) < 1.
Cadmium		3,580	Noncarcinogenic risk from the site (all media) < 1.
Chromium		35,800	Noncarcinogenic risk from the site (all media) < 1.
Copper		48,900	Surface soil background concentration (95% UCL).
Iron		1,370,000	Surface soil background concentration (95% UCL).
Lead		146,000	Surface soil background concentration (95% UCL).
Manganese		604,000	Noncarcinogenic risk from the site (all media) < 1
Mercury		290	Surface soil background concentration (95% UCL).
Nickel		143,000	Noncarcinogenic risk from the site (all media) < 1
Selenium		1,550	Noncarcinogenic risk from the site (all media) < 1
Silver		450	Surface soil background concentration (95% UCL).
Tin		21,500	Noncarcinogenic risk from the site (all media) < 1.
Vanadium		50,200	Noncarcinogenic risk from the site (all media) < 1.
Zinc		1,060,000	Noncarcinogenic risk from the site (all media) < 1.
Cyanide		15,100	Noncarcinogenic risk from the site (all media) < 1.
Methylene Chloride		9.35	Surface soil background concentration (95% UCL).
Acetone		5,190	Noncarcinogenic risk from the site (all media) < 1.
Carbon disulfide	5	0.153	Noncarcinogenic risk from the site (all media) < 1.
Trans-1,2-Dichloroethene		5	Surface soil background detection limit.
Chloroform	0.5	0.163	Carcinogenic risk from the site (all media) < 1 E-06.
2-Butanone		5,900	Noncarcinogenic risk from the site (all media) < 1.
1,1,1-Trichloroethane		564	Noncarcinogenic risk from the site (all media) < 1.
1,1,2,2-Tetrachloroethane	0.3	0.107	Carcinogenic risk from the site (all media) < 1 E-06.
1,2-Dichloropropane		42.2	Carcinogenic risk from the site (all media) < 1 E-06.
Trichloroethene		1.44	Carcinogenic risk from the site (all media) < 1 E-06.
1,1,2-Trichloroethane		2.58	Carcinogenic risk from the site (all media) < 1 E-06.
Benzene	2	0.982	Carcinogenic risk from the site (all media) < 1 E-06.
4-Methyl-2-pentanone		938	Noncarcinogenic risk from the site (all media) < 1.
Tetrachloroethene		2.17	Carcinogenic risk from the site (all media) < 1 E-06.
Toluene		15,900	Noncarcinogenic risk from the site (all media) < 1.
Chlorobenzene	.2	1	Noncarcinogenic risk from the site (all media) < 1.
Ethylbenzene		1,730	Noncarcinogenic risk from the site (all media) < 1.
Xylenes		6,310	Noncarcinogenic risk from the site (all media) < 1.
Phenol		157	Noncarcinogenic risk from the site (all media) < 1.
1,4-Dichlorobenzene		58.7	Carcinogenic risk from the site (all media) < 1 E-06
1,2-Dichlorobenzene		193	Noncarcinogenic risk from the site (all
Cresol	330	66.3	Noncarcinogenic risk from the site (al

TABLE 2 (PAGE 2 OF 2)

Compound	Detection Limit * (ug/kg)	Cleanup Action Levels (ug/kg)	Basis
Isophorone		3,000	Carcinogenic risk from the site (all media) < 1 E-06.
2,4-Dimethylphenol		330	Surface soil background detection limit.
2,4-Dichlorophenol		900	Noncarcinogenic risk from the site (all media) < 1.
1,2,4-Trichlorobenzene	330	36.7	Noncarcinogenic risk from the site (all media) < 1.
Naphthalene		5,710	Noncarcinogenic risk from the site (all media) < 1.
4-Chloroaniline		356	Carcinogenic risk from the site (all media) < 1 E-06.
2-Methylnaphthalene		330	Surface soil background detection limit.
Acenaphthylene		330	Surface soil background detection limit.
Acenaphthene		330	Surface soil background detection limit.
Dibenzofuran		330	Surface soil background detection limit.
Diethylphthalate	330	27.1	Surface soil background concentration (95% UCL).
Fluorene		330	Surface soil background detection limit.
N-Nitrosodiphenylamine	330	269	Carcinogenic risk from the site (all media) < 1 E-06.
Phenanthrene	330	131	Surface soil background concentration (95% UCL).
Anthracene		330	Surface soil background detection limit.
Di-n-butylphthalate		1,360	Noncarcinogenic risk from the site (all media) < 1.
Fluoranthene		255	Surface soil background concentration (95% UCL).
Pyrene		248	Surface soil background concentration (95% UCL).
Butylbenzylphthalate		943	Noncarcinogenic risk from the site (all media) < 1.
Benzo(a) anthracene		158	Surface soil background concentration (95% UCL).
Bis(2-ethylhexyl)phthalate		985	Surface soil background concentration (95% UCL).
Chrysene		238	Surface soil background concentration (95% UCL).
Di-n-octylphthalate	330	36.4	Surface soil background concentration (95% UCL).
Benzo(b) fluoranthene		241	Surface soil background concentration (95% UCL).
Benzo(k) fluoranthene		154	Surface soil background concentration (95% UCL).
Benzo(a) pyrene		137	Surface soil background concentration (95% UCL).
Indeno(1,2,3-cd) pyrene		103	Surface soil background concentration (95% UCL).
Dibenz(a,h)anthracene		330	Surface soil background detection limit.
Benzo(g,h,i)perylene		108	Surface soil background concentration (95% UCL).
4,4'-DDE		44.8	Surface soil background concentration (95% UCL).
Chlordane		4,100	Surface soil background concentration (95% UCL).
PCBs	80	1.62	Carcinogenic risk from the site (all media) < 1 E-06.

* Practical quantitation limits as per USEPA "Test Methods for Evaluating Solid Waste," 3rd Edition, SW-846, Nov. 1986. Values shown are higher than the corresponding cleanup action levels. Therefore, the actual cleanup action level for each of these compounds is "nondetectable."

UCL: Upper confidence limit of the average concentration (Table 14).

TABLE 19

LAND DISPOSAL RESTRICTION TREATMENT STANDARDS FOR WASTE CATEGORIES F001, F002, F003, F005 (FROM 40 CFR 268.41)

CONSTITUENT	CONCENTRATIONS IN EXTRACT mg/l	
	Wastewaters	Non-wastewaters*
acetone	0.05	0.59
n-butyl alcohol	5.0	5.0
carbon disulfide	1.05	4.81
carbon tetrachloride	0.15	0.96
chlorobenzene	0.15	0.05
cyclohexanone	0.125	0.75
1,2 dichlorobenzene	0.65	0.125
ethyl acetate	0.05	0.75
ethyl benzene	0.05	0.053
ethyl ether	0.05	0.75
isobutanol	5.0	5.0
methanol	0.25	0.75
methylene chloride	0.20	0.96
methyl ethyl ketone	0.05	0.75
methyl isobutyl ketone	0.05	0.33
pyridine	1.12	0.33
tetrachloroethylene	0.079	0.05
toluene	1.12	0.33
1,1,1-trichloroethane	1.05	0.41
1,1,2-trichloro-1,2,2 trifluoroethane	1.05	0.96
trichloroethylene	0.065	0.091
trichloroflouromethane	0.05	0.96
xylene	0.05	0.15

*A capacity variance is in effect for soil waste and debris until November 1990.

TABLE 20

PROPOSED LAND RESTRICTION TREATMENT STANDARDS FOR WASTE CATEGORIES F007, F008, F009, (FROM F.R., VOL, 53, NO. 7, P. 1068)

WASTEWATERS:

CONSTITUENT	TOTAL COMPOSITION (mg/l)	TCLP (mg/l)
cyanide (total)	12	
cyanide (amenable)	1.3	
chromium	0.32	
lead	0.04	
nickel	0.44	

NONWASTEWATERS:

	(mg/kg)	(mg/l)
cyanides (total)	110	
cyanides (amenable)	0.064	
cadium		0.066
chromium		5.2
lead		0.51
nickel		0.32
silver		0.072

TABLE 21

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structural/functional groups shown in column 1 of **Highlight 5**. After dividing the BDAT constituents into their respective structural/functional groups, the next step is to compare the concentration of each constituent with the **threshold concentration (see column 3 of Highlight 5)** and to select the appropriate concentration level or percent reduction range. If the concentration of the restricted constituent is less than the threshold concentration, the waste should be treated to within the concentration range. If the waste concentration is above the threshold, the waste should be treated to reduce the concentration of the waste to within the specified percent reduction range. Once the appropriate treatment range is selected, the third step is to identify and select a specific technology that can achieve the necessary concentration or percent reduction. Column 5 of **Highlight 5** lists technologies that (based on existing performance data) can attain the alternative Treatability Variance levels.

During the implementation of the selected treatment technology, periodic analysis using the appropriate testing procedure (i.e., total waste analysis for organics and TCLP for inorganics) will be required to ensure that the alternate treatment levels for the BDAT constituents requiring control are being attained and thus can be land disposed without further treatment.

Because of the variable and uncertain characteristics associated with unexcavated wastes, from which only sampling data are available, treatment systems generally

Highlight 5. ALTERNATE TREATABILITY VARIANCE LEVELS AND TECHNOLOGIES FOR STRUCTURAL/FUNCTIONAL GROUPS

Structural Functional Groups	Concentration Range (ppm)	Threshold Concentration (ppm)	Percent Reduction Range	Technologies that achieved recommended effluent concentration guidance**
ORGANICS				
Halogenated Non-Polar Aromatics	0.5 - 10	100	90 - 99.9	Biological Treatment, Low Temp. Stripping, Soil Washing, Thermal Destruction
Dioxins	0.00001 - 0.05	0.5	90 - 99.9	Dechlorination, Soil Washing, Thermal Destruction
PCBs	0.1 - 10	100	90 - 99.9	Biological Treatment, Dechlorination, Soil Washing, Thermal Destruction
Herbicides	0.002 - 0.02	0.2	90 - 99.9	Thermal Destruction
Halogenated Phenols	0.5 - 40	400	90 - 99	Biological Treatment, Low Temp. Stripping, Soil Washing, Thermal Destruction
Halogenated Aliphatics	0.5 - 2	40	95 - 99.9	Biological Treatment, Low Temp. Stripping, Soil Washing, Thermal Destruction
Halogenated Cyclics	0.5 - 20	200	90 - 99.9	Thermal Destruction
Nitrated Aromatics	2.5 - 10.0	10,000	99 - 99.99	Biological Treatment, Soil Washing Thermal Destruction
Heterocyclics	0.5 - 20	200	90 - 99.9	Biological Treatment, Low Temp. Stripping, Soil Washing, Thermal Destruction
Polynuclear Aromatics	0.5 - 20	400	95 - 99.9	Biological Treatment, Low Temp. Stripping, Soil Washing, Thermal Destruction
Other Polar Organics [illegible] phenol	0.5 - 10	100	90 - 99.9	Biological Treatment, Low Temp. Stripping, Soil Washing, Thermal Destruction
INORGANICS				
Antimony	0.1 - 0.2	2	90 - 99	Immobilization
Arsenic	0.27 - 1	10	90 - 99.9	Immobilization, Soil Washing
Barium	0.1 - 40	400	90 - 99	Immobilization
Chromium	0.5 - 6	120	95 - 99.9	Immobilization, Soil Washing
Nickel	0.5 - 1	20	95 - 99.9	Immobilization, Soil Washing
Selenium	0.005	0.08	90 - 99	Immobilization
Vanadium	0.2 - 22	200	90 - 99	Immobilization
Cadmium	0.2 - 2	40	95 - 99.9	Immobilization, Soil Washing
Lead	0.1 - 3	300	99 - 99.9	Immobilization, Soil Washing
Mercury	0.0002 - 0.008	0.08	90 - 99	Immobilization

* *TCLP also may be used when evaluating waste with relatively low levels of organics that have been treated through an immobilization process.*

** *Other technologies may be used if treatability studies or other information indicates that they can achieve the necessary concentration or percent-reduction range.*

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MIDCO I AND MIDCO II RESPONSIVENESS SUMMARY

I. RESPONSIVENESS SUMMARY OVERVIEW

In accordance with CERCLA Section 117, a public comment period was held from April 20, 1989 to May 19, 1989, to allow interested parties to comment on the United States Environmental Protection Agency's (U.S. EPA's) Feasibility Studies (FSs) and Proposed Plans for final remedial actions at the Midco I and Midco II hazardous waste sites. On April 27, U.S. EPA conducted a public meeting in which the Proposed Plans were presented, questions answered and public comments accepted.

The purpose of this responsiveness summary is to document comments received during the public comment period, and provide U.S. EPA's responses to these comments. All comments summarized in this document were considered in EPA's final decision for remedial action at the Midco I and Midco II sites.

II. BACKGROUND ON COMMUNITY INVOLVEMENT

The Midco I site (as well as another National Priorities List site, Ninth Avenue Dump) is located in Gary, Indiana. The nearest residential area is in Hammond, Indiana within one-fourth mile of the site. On December 21, 1976, a fire at Midco I destroyed thousands of drums of chemicals. Community concern about the site intensified in 1981. In March 1981, a 14-year old Hammond boy suffered leg burns while playing near the site; his parents attributed the burns to chemicals. In June 1981, a heavy rainfall resulted in flooding in Hammond and the flow of surface water from the Midco I and Ninth Avenue Dump areas into Hammond. Several residents complained of chemical odors in flooded basements and chemical burns from contact with flood waters. These problems were attributed to run-off from Midco I and Ninth Avenue Dump. In response to this occurrence, Hammond constructed a dirt dike across Ninth Avenue at the Cline Avenue overpass. This dike is still in place and is a source of controversy between Gary and Hammond public officials. The Indiana Department of Environmental Management sent a letter stating that the dike was still necessary to prevent contamination from the sites from entering Hammond. Gary and Hammond public officials and nearby Hammond residents have been actively involved in promoting remedial actions at Midco I.

The Midco II site is more isolated from residential areas. The nearest residences are a small cluster of homes located approximately one mile southeast of the site. In 1977, a fire occurred at the site that destroyed thousands of drums of chemical wastes.

In 1981, U.S. EPA installed fences around Midco I and Midco II. In 1982, U.S. EPA conducted a surface removal action at Midco I that included removal of all containerized wastes and the top one foot of contaminated soil, and installation of a temporary clay cover. From 1984-1989, U.S. EPA conducted a removal action at Midco II that included the removal of all containerized wastes, and excavation and removal of contaminated sub-surface soils in areas where wastes had been dumped directly onto the ground. On July 8, 1982, a public meeting was held to discuss the Midco I removal action. Other community relations activities were also conducted during the removal actions.

U.S. EPA held public meetings to discuss the initiation of the Remedial Investigation/Feasibility Studies (RI/FSs) on February 21, 1985 for Midco I and on July 18, 1985 for Midco II. Residential well sampling for the RI/FSs identified several contaminated wells, but the contamination was not attributable to the Midco sites. U.S. EPA provided updates to the community on the status of the studies using fact sheets in November 1987 and December 1988.

Proposed Plans for Midco I and Midco II were combined into one fact sheet and mailed to over 100 concerned parties. Oral comments were accepted during the public meeting on April 27, 1989. In addition, written comments were received during the public comment period from the City of Hammond, the Indiana Department of Highways, a private citizen in Gary, a slurry wall contractor, the Midco Steering Committee (which represents the potentially responsible parties that conducted the RI/FSs), and from Morton-Thiokol, Inc.

III. SUMMARY OF SIGNIFICANT COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND U.S. EPA RESPONSES

The comments are organized into the following categories:

A. Comments received during the public meeting, and comments received in writing from the City of Hammond, from a slurry wall contractor and from a private citizen from Gary.

B. Comments received from the Indiana Department of Highways.

C. Comments received from the Midco Steering Committee and from Morton-Thiokol.

A. SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC MEETING, AND COMMENTS RECEIVED IN WRITING FROM THE CITY OF HAMMOND, FROM A SLURRY WALL CONTRACTOR AND FROM A PRIVATE CITIZEN FROM GARY

COMMENT #1:

A number of comments were received concerning the protectiveness of deep well injection of hazardous wastes. The specific comments included the following:

> "In 13 states casings have cracked and leaked in deep well injections."
>
> "Why is it they never address with landfills or deep well injections earthquakes in the area and what they anticipate is going to happen to all these nice little hazardous waste dumps we have either under the ground or on top or wherever they're at."
>
> "I would like to know how many deep wells there are in existence today."

"How long have they been in existence?"

"Have there been any problems with any of them?"

"How does the EPA prevent any problems? Are you saying that because they stepped in there are no more problems or what?"

"Isn't it true that the steel mills stopped disposing of their own waste by deep well injection many years ago? What are they injecting now?"

"I am requesting that ... (2) the E.P.A. report how the preferred option of injecting hazardous wastes two thousand (2,000) feet underground will affect my neighbors' well as my own."

"There is always the possibility that the substance injected into the deep well will contaminate other aquifers."

"In addition, although these aquifers may not currently be used because of their depth, or because they contain salt-water there may come a time when out of necessity they may be needed to supply drinking water to future generations."

"At a minimum the contamination in the ground water should be treated prior to any deep well injections so as to mitigate any adverse environmental effects that may occur in the future."

"The solution to environmental problems is not to place out of sight or to dilute, but to correct."

U.S. EPA RESPONSE TO COMMENT #1:

Congress recognized concerns regarding deep well injection of hazardous wastes and enacted a number of statues to assure that deep well injection is only conducted at locations and using procedures that will assure long-term protection of human health and the environment. Deep well injection is regulated by U.S. EPA under a number of statutes, primarily the Safe Drinking Water Act (SDWA) (Pub. L. 93-523, as amended; 42 U.S.C. 300f et seq.), and the Resource Conservation and Recovery Act (RCRA) (Pub. L. 94-580 as amended; 42 U.S.C., 6901 et. seq.). RCRA was modified by the Hazardous and Solid Waste Amendments (HSWA) of 1984 to restrict land disposal and deep well injection of hazardous wastes. Congress intended that deep well injection be allowed only if it is protective of both current sources of drinking water, and any ground water that could potentially serve as an underground source of drinking water (USDW). A USDW generally includes any aquifer that contains a sufficient quantity of ground water to supply a public water system and contains less than 10,000 mg/l of total dissolved solids (TDS). Recovery of drinking water from an aquifer with a TDS greater than 10,000 mg/l is not considered to be technically or economically feasible. (See 40 CFR 144.3).

Regulations under the SDWA prohibit (with few exceptions) injection of any hazardous waste into a USDW. Hazardous wastes can only be injected into formations that are below the lower-most formation containing, within one-quarter mile of the well bore, a USDW. All injection wells must be permitted by U.S. EPA or an appropriate state agency. Regulations regarding permit requirements have undergone extensive review and public comment. Permit conditions prohibit any injection activity that allows the movement into a USDW of fluid containing any contaminant, if the presence of that contaminant may cause a violation of any primary drinking water regulation (40 CFR 144.12) or may otherwise adversely affect the health of persons. Another permit condition requires permittees to take all reasonable steps to minimize or correct any adverse impact on the environment resulting from non-compliance with the permit. (See 40 CFR 144.12).

Underground injection permits include strict construction, corrective action, operation, abandonment, monitoring, reporting and financial requirements to assure that the injection well is constructed and operated in a manner that will meet U.S. EPA requirements and be protective of human health and the environment.

U.S. EPA's permit review assures that hazardous waste injection wells are only constructed in locations that are geologically suitable. This includes consideration of the following factors:

1) the structural geology, stratigraphic geology, the hydrogeology, and the seismicity of the region (including evaluation of the potential for earthquakes);

2) an analysis of the local geology and hydrogeology of the well site;

3) a determination that the geology of the area can be confidently described and that the limits of waste fate and transport can be accurately predicted through the use of models.

Hazardous waste injection wells must be sited such that:

1) the injection zone has sufficient permeability, porosity, thickness and areal extent to prevent migration of fluids into a USDW;

2) a confining zone is present above the injection zone which is laterally continuous and free of transecting, transmissive faults or fractures over an area sufficient to prevent the movement of fluids into a USDW, and which contains at least one formation of sufficient thickness and with lithologic and stress characteristics capable of preventing vertical propagation of fracture.

In addition, U.S. EPA may require that the owner or operator of a hazardous waste deep well demonstrate either:

1) that the confining zone is separated from the base of the lowermost USDW by at least one sequence of permeable and less permeable strata that will provide an added layer of protection for the USDW in the event of fluid movement in an unlocated borehole or transmissive fault; or

2) that within the area of review, the piezometric surface of the fluid in the injection zone is less than the piezometric surface of the lowermost USDW; or

3) that there is no USDW present.

(See 40 CFR 146.62).

Further data collection is required during construction of the deep well to determine or verify the geology and the quality of the construction. Measurements include resistivity, spontaneous potential, caliper, cement bond, density, temperature, porosity, gamma ray and fracture finder logs, a pressure test, a radioactive tracer survey, core samples, and a casing inspection survey. The injection well must be cased and sealed to prevent any migration of injection fluid up the borehole. A double casing is required from the surface to below the lowermost USDW.

The owner or operator must assure that the injection pressure at the wellhead does not exceed a maximum pressure in the injection zone during injection, and does not initiate new fractures or propagate existing fractures in the injection zone. The injection tubing must be surrounded by an annular space, which is filled with fluid. The injection pressure, flow rate, and volume of injected fluids, and the pressure on the annulus, must be continuously monitored.

U.S. EPA uses three interrelated program requirements to assure compliance with well operating regulations. Mechanical integrity tests measure the operating soundness of the wells, including checking for leaks. Operator reports include information on the waste being injected; the well pressure, flow rate and volume; and report the degree of permittee compliance with these permit conditions. Periodic inspections determine the accuracy of operator self-monitoring and the adequacy of injected-waste sampling. The attached "A GUIDE TO THE FEDERAL UNDERGROUND INJECTION CONTROL PROGRAM IN INDIANA" provides a general description of the permit program and how potential pathways of contamination are controlled in the deep wells.

Congress addressed concerns about the long term protectiveness of landfilling or underground injection of hazardous wastes in the HSWA. This act established land (or deep well) disposal restrictions focused on minimization of land disposal or deep well injection of hazardous wastes. These restrictions prohibit the land disposal or deep well injection of specified hazardous wastes beyond statutory dates established by Congress unless 1) the wastes are treated to a level or method specified by U.S. EPA, 2) it can be demonstrated there will be no migration of hazardous constituents from the disposal unit for as long as the waste remains hazardous, or 3) the waste is subject to an exemption or a variance. The no-migration demonstration mentioned above can be approved by U.S. EPA under the condition that the hydrogeological and geochemical conditions at the sites and the physiochemical nature of the waste stream are such that reliable predictions can be made that:

1) injected fluids will not migrate within 10,000 years vertically upward out of the injection zone, or laterally within the injection zone to a point of discharge or interface with a USDW; or

2) before the injected fluids migrate out of the injection zone or to a point of discharge or interface with USDW, the fluid will no longer be hazardous. (See 40 CFR 148.20)

Such a no-migration demonstration must depend heavily on fluid flow modeling. Fluid flow modeling is a well-developed and mature science, having been used for years in the petroleum industry as well as in recent studies for the Department of Energy nuclear waste isolation program.

U.S. EPA believes that the no-migration petition requirements are so stringent that if such a petition is approved for disposal of the ground water from Midco, deep well injection, even without treatment, will be considered to provide permanent protection to human health and the environment. If the deep well injection system receives approval from U.S. EPA, the injection will have no impact on USDW, which includes any residential wells.

Presently, four steel mills in northwest Indiana are legally injecting hazardous wastes into the Mount Simon aquifer located approximately 2200 feet below the surface. These include U.S. Steel, Inland Steel, Bethlehem Steel and Midwest Steel. Three of these facilities (Inland, Bethlehem and Midwest) have submitted a no-migration demonstration to U.S. EPA for approval in order to allow them to continue hazardous waste injection without treatment. U.S. Steel is expected to submit a demonstration soon. The hazardous wastes being injected are waste pickle liquor and waste ammonia liquor. U.S. EPA expects to make a decision on the no migration demonstrations for these facilities by March of 1990. If the no-migration demonstration is approved for these facilities, it is likely that a similar demonstration will be approved for Midco.

If the no-migration petition is not approved, the contaminated ground water from the Midco sites would have to be treated prior to the deep well injection. The required level of treatment is established nationally as the best demonstrated available treatment method for that type of waste.

It has been estimated that as many as 500,000 injection wells are in operation in the United States, but there are only 191 hazardous waste injection wells. These wells are concentrated in Texas, Louisiana, Illinois, Indiana, Michigan and Ohio. The oldest hazardous wastes injection well dates back to 1951. Use of hazardous waste injection wells underwent a thorough review by the Government Accounting Office in 1986. The results of their investigation are summarized in a document named "Hazardous Waste Controls Over Injection Well Disposal Operations", GAO/RCED-87-170, August 1987.

GAO determined that nationwide, two cases of USDW contamination have been documented by companies operating hazardous waste injection wells. In addition, one case of suspected contamination and eight cases of contamination of water that was already considered unsuitable for drinking have been documented. The USDW contamination occurred in Texas and Louisiana but was not extensive. Program controls now in place prohibit the practice that led to the two cases of drinking water contamination.

The leakage from hazardous waste injection wells into non-drinking water aquifers occurred at eight facilities between 1975 and 1984. The causes of the leakage centered on casing and/or tubing corrosion or deterioration. The most notable of these cases occurred at a commercial facility in Ohio in 1983 where large amounts of waste escaped into an unpermitted zone. This zone was, however, separated from the bottom of the lowermost USDW by more than 1500 feet, of which 1000 feet was confining rock formations. In response, to these and other concerns, and to the Congressional mandate for additional ground water monitoring requirements in the Safe Drinking Water Act Amendments of 1986, U.S. EPA is implementing stricter regulations. This includes:

- more specific well-siting requirements;
- an expanded "area of review" around injection wells for identifying abandoned wells near the injection site, and added requirements for corrective action to plug abandoned wells;
- additional operating procedures, such as automatic well shutoff or alarms; new requirements for testing, monitoring, and reporting, including a waste-analysis plan, additional mechanical integrity tests, and more specific monitoring requirements; and
- new requirements for well closure and post-closure care.

The GAO report also pointed out that the full extent to which injected hazardous waste has contaminated underground sources of drinking water is unknown because of the problems in detecting contamination that may have occurred away from the well-bore. The documented cases of contamination have all occurred near the well-bore. However, regulations require that injection wells not be located in areas where faults occur and that injection pressures be maintained below a level that might cause fractures in the formation. Regulations also require that all man-made holes in the area penetrating the confining zone and entering the injection zone be located and properly plugged. In addition, U.S. EPA is implementing requirements to monitor the migration of the waste movement.

The GAO report concluded that the new deep well injection requirements should provide additional safeguards to prevent the contamination of USDWs. In addition, well owners will be required to demonstrate no migration of hazardous waste.

COMMENT #2:

The City of Hammond comments included a statement that "Preferably the treatment would be to such an extent that the treated groundwater could be reinjected into the aquifer from where it originated."

U.S. EPA RESPONSE TO COMMENT #2:

See our response to Comment #5 below and to Comment #5 from the Midco Steering Committee and Morton-Thiokol.

COMMENT #3:

During the public meeting there were a number of comments concerning whether U.S. EPA puts too much emphasis on costs in its decisions on remedial actions, and whether alternative innovative treatment and disposal technologies were considered. Specific comments included the following:

> "All we're talking is cost effectiveness."
>
> "I don't think it's fair. I think cost should be put aside. These people that are going around polluting should be made to pay. ... It's not costs because these chemicals that leak out cause cancer and a number of other sicknesses. ... How do you put a price tag on one's life? Tell me."
>
> "Those responsible for creating environmental problems must pay the expense of correcting their mistakes."
>
> "They're supposed to be using the best available technology not the most cost effective."
>
> "Stop delving into the pockets of the public."
>
> "Why didn't they decide to use vitrification?"
>
> "I'd like to know if any of these people knew about "The Superfund Innovative Technology Evaluation Program Technology Profiles" or "Assessment of International Technologies for Superfund Applications."

U.S. EPA RESPONSE TO COMMENT #3:

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) was enacted in 1980 to provide broad federal authority and resources to respond to releases (or threatened releases) of hazardous substances. A trust fund was established to pay for remedial actions at abandoned or uncontrolled hazardous waste sites. This fund is predominantly from a tax on petroleum products and on certain chemicals.

Based on the principle that "the polluter should pay," CERCLA contains authorities which allow U.S. EPA to ensure that those responsible for hazardous waste problems pay for necessary remedial actions. CERCLA enforcement authorities enable U.S. EPA to encourage responsible parties to undertake remedial actions. It also enables U.S. EPA to spend trust fund monies for remedial actions and to later recover these monies from responsible parties.

If an acceptable agreement can be reached, U.S. EPA prefers that responsible parties implement the remedial actions. At Midco, an agreement was reached with potentially responsible parties (PRPs) in June 1985, which required the PRPs to reimburse U.S. EPA $3,100,000 for past costs incurred and to conduct a Remedial Investigation/Feasibility Study (RI/FS) at each site in accordance with the U.S. EPA's work plans. U.S. EPA is now negotiating with PRPs for implementation of the remedial actions selected by U.S. EPA and for recovery of the remaining costs incurred. Fund monies will be spent on the final remedial actions only if an agreement is not reached with PRPs.

In CERCLA (as amended by the Superfund Amendments and Reauthorization Act of 1986), Congress mandated that all final remedial actions selected by U.S. EPA must assure protection of human health and the environment, and must meet applicable, and relevant and appropriate Federal and State standards, requirements, criteria, and limitations (ARARs). This includes meeting Federal Primary Maximum Contaminant Levels in the ground water (40 CFR 142). Congress also mandated that U.S. EPA select remedial actions that are cost effective, and that utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. If a remedial action is selected that does not meet this preference, U.S. EPA must publish an explanation as to why a remedy involving such a remedial action was not selected.

The least costly alternative that would be protective of human health and the environment was the containment alternative (Alternative 3), which is estimated to cost $4.7 million at Midco I and $7.9 million at Midco II. U.S. EPA is not selecting these alternatives because they would simply contain the contamination, and the hazards would be similar to taking no action if the cap or slurry wall were ever damaged in the future. Instead, U.S. EPA is selecting remedial actions that it believes will provide permanent protection to human health and the environment. This consists of soil vapor extraction and solidification of contaminated soils combined with pumping and deep well injection of contaminated ground water at Midco I, and the same actions at Midco II except that the soil vapor extraction is not required. In addition, treatment prior to deep well injection will be required if a no-migration demonstration is not approved by U.S. EPA. The estimated cost of these remedial actions at Midco I is from $10.7 to $14.0 million, and at Midco II from $14.4 to $18.6 million (depending on the degree of treatment required prior to deep well injection).

The persons involved in reviewing the Feasibility Studies are familiar with "The Superfund Innovative Technology Evaluation Program: Technology Profiles." The Superfund Innovative Technology Program includes a number of studies on solidification, which is part of the selected remedial actions at the Midco sites. This includes processes by Chemfix Technologies, Hazcon, International Waste Technologies, Silicate Technology Corporation, and Soliditech. Soil vapor extraction, which is part of the remedial action at Midco I, is also included in this program in a process by Terra Vac. Other innovative technologies were considered for treatment of the contaminated soils at the Midco sites but were screened out because they were not considered applicable to the conditions at the site. These include in-situ biodegradation, soil flushing, and chemical treatment. In-situ vitrification and incineration alternatives were evaluated in detail. Vitrification was not selected because it has not been demonstrated to be implementable in a full scale remedial action at a hazardous waste site and because the high water table would make implementation difficult and more expensive. The incineration alternative does not suffer those disadvantages. However, both in-situ vitrification and incineration would be considerably more expensive than solidification and would not contribute significantly to the permanence of the remedial actions if the soil vapor extraction and solidification operations are successful.

Since a surface water discharge would probably not be approved for the salt contaminated ground water even after removal of the hazardous substances, the alternative to deep well injection of the ground water is to concentrate the solids in the ground water by an operation such as evaporation. Evaporation would concentrate at least some hazardous substances into a solid that would have to be disposed of in an off-site landfill. It does not appear that disposal of the hazardous wastes in an off-site landfill is any more protective of human health and the environment than disposal by deep well injection, and the costs of the evaporation operation would be higher than the deep well injection.

COMMENT #4:

"I've been involved in a couple projects, not in this state, where they used in conjunction with the slurry wall a well extraction, and then they leached it back in like a septic field. Then it recirculates. Are these contaminants able to be treated in that respect; and therefore, you wouldn't have deep well disposal and you wouldn't have a lot of things that would be objectionable at this point."

U.S. EPA RESPONSE TO COMMENT #4:

This method of treatment would not be adequate for the highly contaminated soils on the site, but it would be acceptable to U.S. EPA for ground water treatment when combined with a soil treatment measure.

Reinjection of the salt-contaminated ground water following treatment for hazardous substances would be acceptable to U.S. EPA if the reinjection does not cause significant spreading of the salt plume. Installation of a slurry wall and reinjection within the slurry wall is one way of preventing such spreading. This alternative is not preferred over deep well injection at the Midco sites for the following reasons: U.S. EPA believes that deep well injection can be accomplished safely and effectively; it is preferable to remove the salt contaminated ground water from the Calumet aquifer rather than containing it within a slurry wall; and there does not appear to be a cost savings using the slurry wall/reinjection alternative compared to deep well injection.

COMMENT #5:

"As a slurry wall contractor, I would like to comment on the slurry wall pricing listed in your Fact Sheet. I have never seen prices like these, and, as a contractor, I would like to know what they were based on. Today, our prices for Slurry Wall construction range from $3 to $5 per square foot and a bentonite cap $.50 per square foot."

U.S. EPA RESPONSE TO COMMENT #5:

The price estimates were developed by Dames and Moore, a consulting firm employed by the Midco Steering Committee. According U.S. EPAs's contact with this firm, the estimates were based on actual quotes from vendors. The costs were also reviewed by personnel from Roy F. Weston, Inc.

The prices are probably not comparable to the quotes suggested by the commenter because a different type of cap and slurry wall were proposed in the FS. The proposed cap is not just a single-layer bentonite cap. Instead, it is a multi-layered cap consistent with the most recent guidance for RCRA hazardous waste sites. It includes a clay liner, a synthetic liner, a lateral drainage layer, and a vegetative layer. Instead of installation of the slurry wall by the vibrating beam method, installation by a trench/slurry method was proposed. The proposed slurry wall would be approximately three feet thick while a slurry wall installed using the vibrating beam method is only a few inches thick. Safety considerations also add to the cost of actions at a hazardous waste site.

COMMENT #6:

"How deep, how far down has this pollution gone in the sites?"

U.S. EPA RESPONSE TO COMMENT #6:

The contamination appears to be confined to the Calumet aquifer, which extends approximately 30 feet below the surface at Midco I and 40-50 feet below the surface at Midco II. Below the Calumet aquifer is 90-100 feet of low permeability clays and tills.

COMMENT #7:

How many people review the chemical data, and how do the different agencies and other parties work together?

U.S. EPA RESPONSE TO COMMENT #7:

The chemical data was generated by a laboratory that conducted its own quality assurance/quality control (QA/QC) review of the data. The laboratory used in this project is also audited by the U.S. EPA. The chemical data was then sent to a contractor hired by the PRPs, who conducted an independent QA/QC review of the data. The contractor review was also audited by U.S. EPA. A QA/QC review of the data was conducted by a second contractor working for the PRPs.

The PRP contractors conducted an interpretive review of the data, and prepared a report that included plotting the distribution of data on a map, comparison to standards and a discussion of the data. This report was reviewed by at least five persons at U.S. EPA, six personnel working for U.S. EPA contractors, one person from the U.S. Fish & Wildlife Service, and three persons from the Indiana Department of Environmental Management.

U.S. EPA personnel reviewing the data included personnel from the air, water, Great Lakes and RCRA programs, who reviewed the report for concerns specifically related to their programs. The U.S. Fish & Wildlife Service reviewed the report for adequacy of information on ecological effects. Contractors working for U.S. EPA provided support to U.S. EPA with review of costs, hydrogeology, ground water modeling, risk assessment and other areas. A remedial project manager for the U.S. EPA provided an overall review and compiled the review comments from other agencies and contractors for transmittal to the contractor conducting the RI/FS for the Midco Steering Committee. Communications among U.S. EPA employees, other Federal agency employees and U.S. EPA contractors usually consist of informal discussions that are followed up by formal memos.

The Indiana Department of Environmental Management generally prepared their own comments in writing.

COMMENT #8:

"How are you monitoring landfills?"

U.S. EPA RESPONSE TO COMMENT #8:

Hazardous waste landfills are regulated by U.S. EPA under the Resource Conservation and Recovery Act (RCRA) and by the various states under acts similar to RCRA. Under these acts all hazardous wastes entering a landfill must be manifested. A copy of the manifest is sent back to the company that generated the hazardous waste and sometimes back to the state agency in order to verify that the shipment arrived.

The acts also regulate operation and monitoring of the hazardous waste landfills. Monitoring requirements include periodic sampling of ground water near the landfill. Self-monitoring reports including ground water sampling data are periodically sent from the landfill to the agency responsible for oversight of these facilities (which can be Federal or state agencies). Each hazardous waste landfill is also inspected periodically by a state or Federal inspector.

Sanitary landfills are regulated primarily by the states. The IDEM inspects sanitary landfills periodically and requires that ground water monitoring be conducted.

COMMENT #9:

One resident of Gary, Indiana expressed the following concern: "I am concerned by the EPA studies performed on the Porter and Lake County wells which concluded their well water was unsafe to drink. I am requesting that (1) the EPA conduct a study to determine the quality of my neighbors' well as my own..."

U.S. EPA RESPONSE TO COMMENT #9:

The Porter County study referred to is an investigation conducted by the Porter County Health Department of the effects of three landfills in Porter County, Indiana on residential and monitoring wells near the landfills. These landfills will have no impact on well water in Gary, Indiana.

The well of concern is located near 17th and Baker Street in Gary. The identified hazardous waste sites closest to the resident are Midco I and Ninth Avenue Dump (which are approximately two miles away), and Lake Sandy Jo and the Gary City Landfill (which are approximately one mile away). U.S. EPA has conducted detailed investigations at each of these sites. The well of concern was not included in these studies because it was considered to be outside of the area that could be affected by the sites. The results of the investigations confirmed that none of these sites will have any impact on the well of concern. Furthermore, U.S. EPA will conduct remedial actions at the Midco I, Ninth Avenue Dump, and Lake Sandy Jo sites that will eliminate significant health risks, if any, from the sites even to the residents closest to the sites. Ground water at the Gary Landfill is being pumped in a manner that is preventing ground water from the site from flowing off-site.

COMMENT #10:

"If the U.S. EPA would choose an alternative using incineration, we ask that Ordinance #5090, passed by the Common Council of the City of Hammond, be incorporated into the design parameters. We feel the standards incorporated into Ordinance #5090 will protect the health and welfare of those citizens who live adjacent to the site."

U.S.EPA RESPONSE TO COMMENT #10:

The alternative selected by U.S. EPA in this ROD does not include incineration. If incineration was conducted, the U.S. EPA would not consider the City of Hammond's incinerator regulations to be either an applicable, or relevant and appropriate requirement since the operation would be conducted outside the city limits of Hammond. However, U.S. EPA will likely reach similar goals through requiring compliance with standards set by the RCRA, TSCA and CERCLA programs. These include the following:

1) Each principal organic hazardous constituent in the waste must be reduced to 0.01% of the original concentration before emission into the air. The RCRA program refers to this as 99.99% destruction and removal efficiency. Some of the more toxic compounds, including polychlorinated biphenyls, must be reduced to 0.0001% of the original concentration.

2) Hydrochloric acid emissions, if greater than 4 pounds per hour, must be reduced by 99%. Emissions of particulate matter may not exceed 0.08 grains per dry standard cubic foot.

B. SUMMARY OF COMMENTS FROM THE INDIANA DEPARTMENT OF HIGHWAYS:

COMMENT #1:

"The FS report fails to clearly define the contaminant transport mechanism that has caused dissolved salt contaminants (e.g. chlorides) to migrate from the IDOH Subdistrict site, against the prevailing ground water flow direction and hydraulic gradient, and be deposited in the ground water underlying the Midco I site."

U.S. EPA RESPONSE TO COMMENT #1:

The mechanism is explained on pages 1-13, 4-19, and 5-32 of the "Remedial Investigation of Midwest Solvent Recovery, Inc. (Midco I)" dated December 1987, as follows: "Chloride values were also high (up to 7,700 mg/l) in shallow wells (10-foot-deep) in a band extending through the middle portion of the site (MW7, MW6, MW5, Figure 5-25). ... This band occurs in a former swale area that received run-off from the Indiana State Highway Department property prior to Midco I as documented on September 1973 aerial photographs. The evidence suggests that chloride in the shallow wells was derived from concentrated NaCl surface run-off percolating downward to ground water in the former swale area."

COMMENT #2:

"It is plausible that other chloride-containing wastes (e.g., pickle liquor, waste oils containing chlorinated paraffins, etc.) were improperly managed or disposed of on the Midco I site and that IDOH is, therefore, not the sole source of chloride contamination in the site area."

U.S. EPA RESPONSE TO COMMENT #2:

U.S. EPA agrees that the Midco I site operations likely made a contribution to the salt contamination in the ground water below and down gradient from the site. U.S. EPA believes that both IDOH and the Midco I operations contributed to this salt contamination, but the amount attributable to each source cannot be determined.

COMMENT #3:

"Also the FS report fails to distinguish between reactive cyanides, which were likely present on Midco I, and complexed ferrocyanide, which was used by IDOH as an anti-caking agent in the salt. The complexed ferrocyanide poses little risk to human health or the environment under most conditions, while the reactive forms are of greater environmental concern. "Additional technical evaluation of the type, distribution, and potential impact of the cyanide contaminants in the subsurface environment should be conducted."

U.S. EPA RESPONSE TO COMMENT #3:

Four rounds of sampling were conducted for cyanide. The last round included tests for cyanide amenable to chlorination as well as total cyanide. U.S. EPA agrees that reactive forms of cyanide (some of which were likely disposed of at Midco I) are more hazardous to human health and the environment than complexed ferrocyanide.

COMMENT #4:

FS Figure 1-32 showing the distribution of cyanide in the aquifer is misleading and improperly constructed.

U.S. EPA RESPONSE TO COMMENT #4:

U.S. EPA agrees that Figure 1-32 in the draft FS was misleading and improperly constructed. This Figure was removed from the final FS report, at the request of U.S. EPA. U.S. EPA agrees that the highest cyanide concentrations are in the east-central portion of the Midco I site.

COMMENT #5:

"CALs (cleanup action levels) have not been established for chlorides in soil, ground water, or surface waters at the Midco I site, an apparent indication that no site-specific health or risk-based factors have been determined for this parameter."

U.S. EPA RESPONSE TO COMMENT #5:

The salt contamination in the ground water has been viewed as a concern primarily because of the loss of a resource (that is, usage of the ground water) rather than as a human health or environmental hazard. In spite of this, there are some human health and environmental hazards from the salt contamination. Sodium greater than 20 mg/l in drinking water can have a negative health effect on persons on a low sodium diet. High salt content can also have an impact on fresh water aquatic life.

COMMENT #6:

"An independent study commissioned by IDOH did not disclose total cyanide in surface and subsurface soils at concentrations exceeding the soil CAL (136 ppm); the soil levels detected were typically 1 to 2 orders of magnitude below the CAL. Only 2 of 16 ground water samples collected from monitoring wells on the IDOH property exceeded the ground water CAL for cyanide (10.4 ppb).

U.S. EPA RESPONSE TO COMMENT #6:

U.S. EPA can respond to this comment once the referenced data has been sent to U.S. EPA for review.

COMMENT #7:

IDOH recommended that the alternative of discharge to the City of Hammond sewer system be reevaluated. It was argued that the discharge of salt from the Midco I ground water, would be minor compared to the present salt load discharged to the Hammond Wastewater Treatment Plant.

U.S. EPA RESPONSE TO COMMENT #7:

In general, discharge of highly saline wastewater to a POTW is not allowed due to potential interference in the biological treatment processes. In addition, the Hammond Wastewater Treatment Plant is already exceeding its discharge limitation for chloride. The highly salt contaminated discharge from Midco I would cause an even greater exceedance. Discharge to the Hammond Wastewater Treatment Plant may also be restricted by the U.S. EPA off-site policy, which requires that facilities used for disposal of wastes in the CERCLA program must be in compliance with applicable Federal and State regulations.

C. Comments from the Midco Steering Committee and from Morton Thiokol, Inc.:

COMMENT #1:

U.S. EPA did not select a cost-effective remedy for soils or ground water.

U.S. EPA RESPONSE TO COMMENT #1

See U.S. EPA's response to the following comments from the Midco Steering Committee and the response to Comment #3 from the public meeting, etc.

COMMENT #2:

The assumptions used in the risk assessment are unrealistic.

U.S. EPA RESPONSE TO COMMENT #2:

U.S. EPA required that the risk assessment include a scenario that assumed that each site would be developed for residential or industrial use. This is a standard procedure for CERCLA sites. The particular assumptions used in the risk assessment had to be consistent with standard U.S. EPA risk assessment practices as expressed in the Superfund Public Health Evaluation Manual (SPHEM). Parameters and assumptions that were not spelled out in the SPHEM were selected by Environmental Resources Management Inc. with review and concurrence by U.S. EPA.

COMMENT #2A:

Ingestion rates and dermal contact rates for the contaminated soils were unrealistic. In addition, it is unrealistic to assume that there would be no degradation of contaminants over time.

U.S. EPA RESPONSE TO COMMENT 2A:

U.S. EPA's current guidance for soil ingestion rates for use in CERCLA and RCRA risk assessments is more stringent than that used in the FSs. To promote consistency within the Agency, U.S. EPA has recommended soil ingestion rates for use in risk assessments in a memo from J. Winston Porter dated January 7, 1989. These rates are 0.1 grams per day for adults and 0.2 grams per day for children ages 1-6. These rates are based on the most recent reliable data reviewed by the Agency, and represent reasonable conservative values. The guidance does not address children who exhibit pica behavior because the occurrence of pica behavior and the associated rates of soil ingestion have not been adequately defined. The FS assumed that 1 gram per day would be ingested by children ages 2-6, 0.1 gram per day for children ages 6-12 (only for Midco I), and no ingestion after that age.

The estimated, lifetime cancer risk is proportional to the total lifetime exposure. Using the assumptions in the Midco Feasibility Study (FS) the total lifetime amount of soil ingestion is between 1,715 and 2,044 grams. Using the new recommended rates, the lifetime soil ingestion is 2,774 grams. As can be seen, the lifetime cancer risk estimate will be higher using the new rates than the rates used in the FS. In addition, using the assumptions in the FS, there would be no further exposure following the age of 12, but using the new rates there would be continued exposure.

The risks from soil ingestion in the industrial development scenario are less than in the residential development scenario, but are still substantial. Some types of exposure that can occur after age 12 could also occur under the industrial development scenario. Assuming 30 years of exposure at 0.1 gram per day equals 1,095 grams in a lifetime using the industrial development scenario. This is approximately 60% of the lifetime ingestion used for risk calculations in the FS, and, therefore, the same percentage of the lifetime, carcinogenic risk.

The dermal contact rates used in the FS were proposed by Environmental Resources Management. Personnel from U.S. EPA and PRC Environmental Management, Inc. (PRC) reviewed the proposed rates and felt that they were reasonable conservative assumptions.

Degradation/removal of contaminants does occur over time due to volatilization and biodegradation. However, the rate of these processes is generally very slow for some of the chemicals of most concern, including polychlorinated biphenyls, lead, arsenic, and polyaromatic hydrocarbons.

COMMENT #2B:

It is unrealistic to assume that residential development could occur at these sites. In addition, Midco II is included in the City of Gary airport's expansion plans.

U.S. EPA RESPONSE TO COMMENT #2B:

U.S. EPA disagrees with this assertion. While it is not possible to know whether residential development will occur, it appears to be quite possible since there are already residences located in industrial areas near these sites. This includes a residence located 500 feet south of the Midco I site on Blaine Street. It is across the street from Calumet Waste Systems and near General Drainage. The residents at this location utilize the Calumet aquifer for drinking and have a garden. Another property adjacent to General Drainage is used for gardening by a Hammond resident.

There are a number of residences at the corner of Clark Road and Industrial Highway, which is one mile southeast of Midco II. These residences are across the street from House's Junk Yard, and adjacent to Samocki Brothers Trucking. Two of the residences formerly used the Calumet aquifer for drinking, and a number of the residences have gardens.

The Gary City Airport is one of three sites being considered for the third regional airport for the Chicago area. If the Gary Airport site is selected, the Midco II property may be incorporated into the airport. However, this is still very uncertain. Even if Midco II is incorporated into the Gary City Airport, this may not eliminate the risks from contact with the contaminated soils or ground water if no action is taken.

COMMENT #2C:

It is unrealistic to assume this ground water may be used for drinking (at an ingestion rate of two liters per day), and for bathing because of the salt contamination in the aquifer and difficulty in obtaining a permit for well installation.

U.S. EPA RESPONSE TO COMMENT #2C:

The most contaminated portions of the Calumet aquifer at each site is in the shallow portion of the aquifer. In the shallow portion, chloride was generally in the range of 1,000 mg/l at each site. Water is drinkable with this concentration of chloride, although it has an undesirable taste. Two residences near the corner of Clark Road and Industrial Highway formerly utilized wells that only pumped from the shallow portion of the Calumet aquifer. This is evidenced by statements by the residents that their wells ran dry due to pumping at Samocki Brothers.

Ground water contaminated with 1,000 mg/l chloride is common in sanitary landfill plumes. If a landfill site is on the National Priorities List and the plume contains hazardous substances above cleanup action levels, remediation of the plume is often required by U.S. EPA under CERCLA irrespective of the presence of the chloride plume or the fact that the hazardous waste contributors may not have been the primary cause of the chloride contamination. Similarly, the hazardous substances from the Midco sites must be remediated irrespective of the presence or the source of the chloride contamination.

Besides the three residential wells previously mentioned, sixteen residential drinking water wells were located in the City of Gary that are potentially down gradient from Midco I. Since the State of Indiana had no record of these wells, it appears that none of them had a permit.

For the industrial development scenario, the risk level would be similar to that for residential development because the primary risk is due to ground water ingestion. In an industrial situation, actual water consumption depends on the level of activity and the work environment. For extreme cases, consumption of as much as 19 liters of water per day can be normal. A standard consumption figure of 2 liters/day is reasonable for both 1) total daily consumption by the general population and 2) working day consumption by a mix of workers.

COMMENT #2D:

The risk assessment should take into account the number of persons exposed and the risk compared to other cancer agents.

U.S. EPA RESPONSE TO COMMENT 2D:

The SPHEM and Agency policy for risks assessments for CERCLA sites address both future potential risk and present risk. As a result, under CERCLA, U.S. EPA often bases its remedial actions more on potential for usage of an aquifer or for future development of a site than on the present population affected. At the Midco sites, U.S. EPA is taking into account that the Calumet aquifer is little used and has other contaminant sources by only requiring clean up to the 10^{-5} lifetime carcinogenic risk level rather than the 10^{-6} risk level that is normally required in Region V. In addition, the potential for development of Midco II is considered to be lower than usual; thus the 10^{-5} risk level is being used for the soil clean up.

Under CERCLA and RCRA, Congress has mandated that U.S. EPA address and remediate risks from hazardous waste management and disposal. It is U.S. EPA's responsibility to address and remediate these risks irrespective of other risks that are present in every day life.

COMMENT #3:

Direct soil treatment is unnecessary, and Alternatives 7 and 8 (which include direct soil treatment by solidification and soil vapor extraction as well as a final site cover and ground water pumping), do not provide any reduction in institutional controls or significant additional protection compared to Alternatives 4A and 4C (which only include ground water pumping and installation of a final site cover).

U.S. EPA RESPONSE TO COMMENT #3:

The Midco Steering Committee proposes that Alternatives 4A or 4C include a silty clay cover so that contaminants in the soils would be slowly leached into the ground water and recovered in the ground water pump and treatment system.

Alternatives 4A and 4C would leave a large reservoir of untreated hazardous substances in the on-site soils. At Midco I, this includes an estimated 70,000 lbs. of volatile organic compounds, 60,000 lbs. of copper, 30,000 lbs. of zinc, 20,000 lbs. of chromium, 10,000 lbs. of lead, 10,000 lbs. of phenol, 10,000 lbs. of cyanide, 7,000 lbs. of bis(2-ethyl-hexyl)phthalate), 5,000 lbs. of polyaromatic hydrocarbons, and 100 lbs. of polyaromatic hydrocarbons. At Midco II, this includes an estimated 100,000 lbs. of copper, 70,000 lbs. of zinc, 30,000 lbs. of lead, 20,000 lbs. of volatile organic compounds, 20,000 lbs. of chromium, 8,000 lbs. of arsenic, 1,000 lbs. of cyanide, and 400 lbs. of polychlorinated biphenyls. These weights are calculated by multiplying the trench average concentrations by the estimated pounds of soils to be treated, assuming that one cubic yard equals one ton.

This large reservoir of hazardous substances presents a future risk due to its potential to continue contamination of the aquifer and due to potential for direct ingestion and direct contact hazards. It appears very unlikely that this large reservoir of contamination will be adequately removed using only passive uncontrolled natural leaching even for a long period of time. It is quite possible that, if the site cap is disturbed in the future, renewed ground water contamination would be caused even after many years of ground water pumping and attainment of ground water cleanup action levels. Leaving the hazardous substance reservoir without treatment, would also require that the ground water pumping system operate for a much longer period of time.

Although the predominant risk is due to ground water ingestion in the future usage scenario, the risks due to direct soil ingestion are also likely to be unacceptable in case of future development of the site, if the contaminated soils are not treated. A number of the chemicals of most concern for the soil ingestion hazard are relatively immobile in soils. This includes arsenic, polyaromatic hydrocarbons, polychlorinated biphenyls, bis(2-ethylhexyl)phthalate, and lead. Even if these chemicals alone remained in the contaminated soils at or near their present concentrations, the residual risks due to soil ingestion would be unacceptable. At Midco I, the estimated lifetime cancer risk would be 3 X 10^{-5}, and at Midco II, 3 X 10^{-4}. In addition, unacceptable subchronic risks would remain for lead and bis(2-ethylhexyl)phthalate at Midco I, and an unacceptable chronic non-carcinogenic risk would remain at Midco II because of arsenic. The risk levels used above are from the "Addendum to Public Comment Feasibility Study" dated March 7, 1989, except for the subchronic risk, which is from the Remedial Investigation.

A further justification for direct treatment of the contaminated soils at Midco I and Midco II is that concentrations of some chemicals are similar to concentrations in some listed hazardous wastes, for which treatment is required prior to land disposal under the Land Disposal Restrictions (40 CFR 268). This includes chromium and lead at Midco I, and chromium, lead and arsenic at Midco II.

The remaining health risks due to ingestion of the contaminated soils for Alternatives 4A and 4C could be controlled by access restrictions. However, Congress has mandated that U.S. EPA implement remedial actions that utilize treatment to permanently reduce the toxicity, mobility or volume of hazardous substances to the extent practical. Given the Statute's preference and the uncertainty of their long term effectiveness, U.S. EPA seeks to avoid primary reliance on access restrictions, institutional controls and containment measures. U.S. EPA believes that solidification combined with soil vapor extraction will provide permanent protection from the hazards due to the contaminated soils at this site (if treatability tests show they will work). However, since solidification of hazardous wastes has not been practiced long enough to fully evaluate its long term effectiveness, long term monitoring and institutional controls will be required for Alternatives 7 and 8.

COMMENT #4:

The effectiveness of the solidification/stabilization process is uncertain.

U.S. EPA RESPONSE TO COMMENT #4:

The solidification/stabilization (S/S) has been selected as the best demonstrated available technology for treatment of hazardous wastes containing cadmium, chromium, lead, nickel, silver, arsenic and selenium. This is based on results of tests listed in an attachment to this ROD. While S/S may not be effective in immobilizing organic compounds, tests have shown that organic contaminated soils can be solidified into a low permeability, high compressive strength material. The Record of Decision for each site provides for adjustment of the quality of the final site cover depending on the degree of effectiveness of the solidification process. If after solidification, significant potential for future ground water contamination exists, then an extremely impermeable cap such as the one described for

Alternative 2 in the FS, may be required. If solidification is very effective, a less complex final site cover would be acceptable.

U.S. EPA has a strong preference for permanent remedial actions, and believes that incineration followed by solidification is more certain to provide permanent treatment of the contaminated soils. Incineration would reliably, and permanently destroy the organic contaminants and would leave a residual ash that could be more easily solidified because the organic compounds would be removed. On the other hand, incineration is considerably more expensive and solidification combined with soil vapor extraction has the potential to provide the same degree of protection. Therefore, at this time, U.S. EPA prefers to implement the solidification alternative pending the results of the treatability tests.

COMMENT #5:

"Solidification of the Midco II soils might interfere with and preclude the contemplated expansion of the City of Gary Airport."

U.S. EPA RESPONSE TO COMMENT #5:

Measures will be taken to make the remedial actions at Midco II compatible with the Gary Airport expansion if this occurs.

COMMENT #6:

The harm caused by releases of the chlorides to the ground water is divisible from any impact from the Midco sites and costs can be apportioned for the chloride contamination.

U.S. EPA RESPONSE TO COMMENT #6:

While U.S. EPA does not agree with this statement, it is not relevant to the selection of a remedy, but rather to the liability ramifications. U.S. EPA noted that the Midco operations themselves likely contributed to the chloride contamination. Available site records indicate that 39,010 gallons ferric and ferric chloride wastes and 60,755 gallons of liquid waste containing 5% HCl were taken to Midco I or Midco II. Other wastes taken to the sites, whose records do not identify the waste type, may also have contained high chlorides. Some of these wastes were likely spilled onto the ground or dumped into pits into the aquifer in accordance with the disposal practices for these sites. In addition, at Midco I, the swales in the northern half of the site were filled with unknown materials during the Midco operations. It is possible that this fill contributed to the chloride contamination at Midco I.

Moreover, U.S. EPA does not agree with the suggested procedure for calculation of the incremental remedial action costs attributable to the salt contamination. The procedure proposed by the Midco Steering Committee assumes that all costs of the deep well injection operation should be considered incremental costs attributable to the salt contamination. This is not correct, because the costs for treatment are substantially reduced when using the deep well injection alternative compared to the treatment costs for discharge to surface waters or to ground water (even without treatment of the salt). In fact, deep well injection without treatment could be less expensive than treating to surface water discharge standards or to drinking water standards (even without treatment of the salt). For example, the estimated incremental cost for treating the ground water to drinking water standards (other than chlorides) at Midco I is $3,938,000 (present worth of alternative 4C minus 4A plus $675,000 for the petition demonstration), while the costs attributable to the deep well injection operation in Alternative 4A is $3,137,000. Similarly, at Midco II the estimated incremental cost of treating to drinking water standards is $4,910,000, while the cost attributable to the deep well injection operation in Alternative 4A is $3,491,000.

If treatment to meet Land Disposal Restrictions is required prior to the deep well injection, then the cost of the deep well injection system would be increased considerably, but the degree of treatment required would still be less than that required for reinjection into the Calumet aquifer or for discharge to the Grand Calumet River.

The primary objective of the remedial actions at the Midco I and Midco II sites is to address the contamination by hazardous substances and not by chlorides. Nevertheless, chlorides that are captured by the ground water treatment system must be disposed of properly. This is consistent with the approach that U.S. EPA takes at other sites. For example, at landfill sites, chlorides are often mixed with the hazardous waste plume. In spite of the fact that the primary objective of remedial actions at these sites is to address the hazardous substances and not the chloride plume, the chlorides that are present in any ground water pumped from the ground must be properly disposed of by the party conducting the remedial action at landfill sites.

COMMENT #7:

The State of Indiana should issue a variance allowing the discharge of the treated Midco I ground water to the Calumet aquifer:

U.S. EPA RESPONSE TO COMMENT #7:

The State of Indiana does not have primacy for the underground injection control program. Therefore, any underground injection must be approved by U.S. EPA. The reinjection well would be considered class IV unless the waste is delisted, since the ground water contains listed hazardous wastes. This reinjection is not prohibited if it is conducted for cleanup of a release under CERCLA or RCRA. CERCLA will allow this reinjection if the contaminated ground water meets the cleanup action levels and does not allow significant spreading of the salt plume.

For clarification, there appears to be three ways to reinject without spreading the salt plume. One would be to construct a slurry wall around the site, pump and treat the ground water within the site, and reinject the ground water within the slurry wall. Another alternative would be to pump and treat the ground water for both hazardous substances and chlorides (such as by evaporation) and reinject the treated ground water off-site (Alternative 4E). The third is to pump ground water, treat it and reinject it near the site in a manner that would not spread the salt plume.

COMMENT #7:

The State of Indiana should issue a National Pollutant Discharge Elimination System permit allowing the discharge of the salty ground water to the Grand Calumet River following treatment of hazardous substances.

U.S. EPA RESPONSE TO COMMENT #7:

Dames and Moore, who conducted the FS for the Midco Steering Committee, concluded that the State of Indiana would not allow a discharge to the Grand Calumet River without reducing chloride levels. However, in order to respond to the comment from the Midco Steering Committee, U.S. EPA has contacted IDEM and conducted some additional internal discussions. Personnel with the IDEM water compliance section stated verbally that a preliminary review of data from the Grand Calumet River indicated that no excess capacity exists in the chloride allocations for the Grand Calumet River, and that preliminarily, it did not appear that the State would allow a discharge with a chloride concentration higher than 500 mg/l for the Midco sites. U.S. EPA followed up these conversations with a letter requesting a formal determination on this matter.

COMMENT #8:

Cleanup action levels should be periodically revised.

U.S. EPA RESPONSE TO COMMENT #8:

This is provided for in the RODs.

COMMENT #9:

Only one deep well should be installed to serve both of the Midco sites.

U.S. EPA RESPONSE TO COMMENT #9:

This is allowed for in the RODs. However, it is not clear why the Steering Committee feels the shared well should be located at Midco I, since Midco II will have a higher flow rate and has a larger area.

COMMENT #10

"The U.S. EPA and the State should seriously consider prohibiting use of the Calumet aquifer as a source of drinking water due to the salinity issue."

U.S. EPA RESPONSE TO COMMENT #10

The results of the Midco Remedial Investigations indicated that the salt contamination had only affected limited portions of the Calumet aquifer. Although the Calumet aquifer is susceptible to contamination by surface sources, it is the intent of RCRA and CERCLA to control or remediate these potential contaminant sources so that aquifers like the Calumet aquifer can be safely used.

A GUIDE
to the
FEDERAL
UNDERGROUND INJECTION
CONTROL PROGRAM
in
INDIANA

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to the
U. S. Environmental
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About the Guide

This guide is intended to familiarize the public with the regulations for the Underground Injection Control (UIC) Program. Technical criteria for the program were published in the Federal Register June 24, 1980 and codified as Part 146 of Title 40, Code of Federal Regulations. Procedural requirements, state approval process, and the permit issuing process were promulgated on May 19, 1980 as part of the Consolidated Permit Regulations as revisions to 40 CFR, Parts 122, 123 and 124. The Part 122 and 123 Regulations were deconsolidated as technical amendments on April 1, 1983 (48 Fed. Reg. 14145) and now appear as Parts 144 and 145 of 40 CFR.

Subsequent to the promulgation of these regulations, the Safe Drinking Water Act was amended. Among other changes, the amendments added a new Section 1425 to the Act. Section 1425 establised an alternative method for a state to obtain primary enforcement responsibility for those portions of its UIC program related to the recovery and production of oil and gas. The May 19, 1981 Federal Register (Vol. 46, No. 96, p. 27333) contains Section 1425 guidelines.

Also, the Environmental Protection Agency amended the regulations listed above on August 27, 1981 and February 3, 1982. These amendments were promulgated as part of a legal settlement reached with a number of companies, trade associations, and the State of Texas.

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I. THE UIC PROGRAM IN PERSPECTIVE

National Concern for Ground Water

Most areas of the United States are underlain by geological formations or strata that are capable of yielding usable quantities of water. Such geological formations are called aquifers.

People have long relied on aquifers as the source of high-quality water. Today, about half of the American population uses ground water for its domestic needs.

In the arid areas of the country, aquifers are often the only source of water available. And with increased usage of water by industry, homes, and municipalities, national reliance on ground water is expected to increase.

Ground water is also a vital link in the water cycle. Aquifers are replenished by rainfall or other surface water percolating through the soil. In turn, ground water supplies the base flow of many streams and feeds lakes through underground springs.

Recent years have seen a growing concern for the quality of ground water. Pollutants in surface waters or substances deposited on the soil (e.g., pesticides and fertilizers) may be carried into aquifers in the replenishment process. The land disposal of wastes (e.g., into injection wells, landfills, and surface impoundments) can also cause contaminants to enter ground water.

Injection wells can be either beneficial or a major problem in this regard. It is estimated that perhaps as many as 500,000 injection wells are in operation nationwide. These wells involve a broad variety of practices from beneficial purposes (e.g., aquifer recharge and the production of oil, gas and minerals), to the improper disposal of toxic and hazardous wastes.

The contamination of ground water is a matter of grave concern. Ground water is usually assumed to be of high quality and is often used with little or no treatment. Contamination is usually discovered when the consumer becomes ill and, in many cases, the only practical solution is to search for another source of fresh water. Because of the slow movement of ground water, it may be decades or even centuries before the aquifer is once more usable. In some cases, the contamination can never be reversed and the resource may be lost forever. Finally, the effort to clean up the nation's surface waters is hampered if the base flow of streams is already contaminated.

Congress Acts

Congress recognized these potential threats to ground water when, in the Safe Drinking Water Act of 1974

(P.L. 93-523), it instructed the Environmental Protection Agency (EPA) to establish a national program to prevent underground injections which endanger drinking water sources. More specifically, the Safe Drinking Water Act (SDWA) requires EPA to:

- o Publish minimum national requirements for effective State Underground Injection Control (UIC) programs.
- o List states that need UIC programs.
- o Make grants to states for developing and implementing UIC programs.
- o Review proposed state programs and approve or disapprove them.
- o Promulgate and enforce UIC programs in listed states if the state chooses not to participate or does not develop and operate an approvable program.

Several points are worth noting about the statutory mandate. First, the SDWA was intended to head off what Congress perceived as an emerging problem. The committee report accompanying the Act (H. Rept. 93-1185, p. 32) makes clear that no burden is laid on EPA or the state to prove actual contamination before establishing regulations or enforcing them. Second, UIC is clearly to remain a state program. States are expected to assume primary responsibility for fashioning and operating effective programs in their states. The EPA is required to step in only if a state chooses not to participate in the program or fails to administer its program effectively. EPA also has direct responsibility on Indian lands. Third, Congress enjoined EPA to observe three provisions in establishing regulations. The regulations:

- Are not to interfere with or impede oil and gas production unless necessary to protect underground sources of drinking water.
- Are not to disrupt effective existing state programs unnecessarily.
- Are to take local variations in geology, hydrology and history into account.

Background of the Regulations

EPA originally proposed regulations to implement Part C of the Safe Drinking Water Act (SDWA) on August 31, 1976. That proposal included the program regulations and the technical criteria and standards for the UIC program. Numerous written comments were filed and many persons commented at three public hearings.

After careful review of those public comments, EPA determined that there were many ways that the initial proposal could be made generally more flexible and less burdensome without sacrificing the resulting environmental protection to any significant degree. Further, in the fall of 1978, the Agency decided to consolidate the regulations for its major permit programs.

As a consequence of these decisions, the UIC program regulations were reproposed on April 20 and June 14, 1979.

After five public hearings and review of public comments the Agency promulgated final Consolidated Permits Regulations on May 19, 1980 and Technical Criteria for state UIC programs, on June 24, 1980.

A number of trade associations, mining companies, oil and gas producers, iron and steel producers, and the State of Texas petitioned for review of these regulations. In all a list of 93 issues was filed by the petitioners with the Court of Appeals for the District of Columbia Circuit. In response to the legal challenge, the Agency proposed amendments to the regulations on October 1, 1982 and promulgated final amendments to its Consolidated Permit Regulations and Technical Criteria and Standards for state UIC programs on August 27, 1981 and February 3, 1982. However, on April 1, 1983, the UIC regulations were deconsolidated from EPA's other permitting programs.

Thus, public comments, further study, amended legislation and internal management improvements are the principal foundations of the UIC program.

II. MAJOR CONCEPTS OF THE UNDERGROUND INJECTION CONTROL PROGRAM

Congress intended the UIC program to protect not only the ground water which already serves a source of drinking water but also the ground water that could potentially serve as an underground source of drinking water (USDW). The regulations propose, therefore, that all aquifers or portions of aquifers currently serving as drinking water sources be designated for protection. Furthermore, any other aquifer or portion of it which is capable of yielding water containing 10,000 or fewer milligrams per liter of total dissolved solids should also be designated.

However, not all underground water sources are suitable for providing drinking water. Some aquifers are used for producing minerals, oil and gas, or geothermal energy. Others are so contaminated or located in such a manner that recovery of water for drinking purposes is neither economically practical nor technologically feasible. An exempted aquifer is an aquifer or portion which would normally qualify as a USDW but which for any of several specified reasons has no actual potential for providing drinking water and has been affirmatively identified by EPA as an exempted aquifer. If EPA exempts an aquifer or portion of an aquifer, it is not treated as a USDW subject to the protections of these regulations.

Some Significant Terms Used in the UIC Program

Aquifer - Any geologic formation which is capable of yielding usable quantities of ground water.

Well - A bored, drilled, or driven shaft, or dug hole, whose depth is greater than the largest surface dimension.

Well Injection - The emplacement of fluids into the ground (except drilling muds and similar materials used in well construction) through a bored, drilled, driven or dug well.

Fluids - Materials or substances which flow or move, whether semi-solid, liquid, sludge, or any other form or state.

Mechanical Integrity - A general standard for injection wells which signifies that there is no: (1) significant leakage in the well's casing, tubing or packer; and (2) significant movement of fluids between the outermost casing and the well bore.

Migration of Fluids - The movement of fluids from the well or the injection zone into underground sources of drinking water.

Area of Review - The area on the surface surrounding an injection well within which all wells that penetrate the injection zone must be reviewed and, if necessary, repaired. It may be defined in terms of a fixed radius of not less than 1/4 mile from the injection well. Alternatively, the area of review may be computed by the use of a mathematical formula which predicts the lateral distance over which the incremental pressure generated by the injection may cause the upward migration of fluids from the injection zone through faults, improperly abandoned wells, or improperly completed producing wells.

Potential Pathways of Contamination

The basic concept of the proposed UIC program is to prevent the contamination of underground sources of drinking water by keeping injected fluids within the well and in the intended injection zone. There are five major ways in which injection practices can cause fluids to migrate into underground drinking water sources. The following discussion describes each pathway and summarizes the technical requirements proposed in the regulations to prevent migration through that pathway.

Reproduced from best available copy

1. Faulty Well Construction

Leaks through the well casing or fluid forced back up between the well's outer casing and the well bore, as illustrated in Figure 1, may cause contaminant migration into a USDW.

Preventive Requirements

The regulations require adequate casing to protect drinking water sources, and adequate cementing to isolate the injection zone. Mechanical integrity, defined as the absence of significant leaks and fluid movement in the well bore, must be demonstrated initially and every five years thereafter.

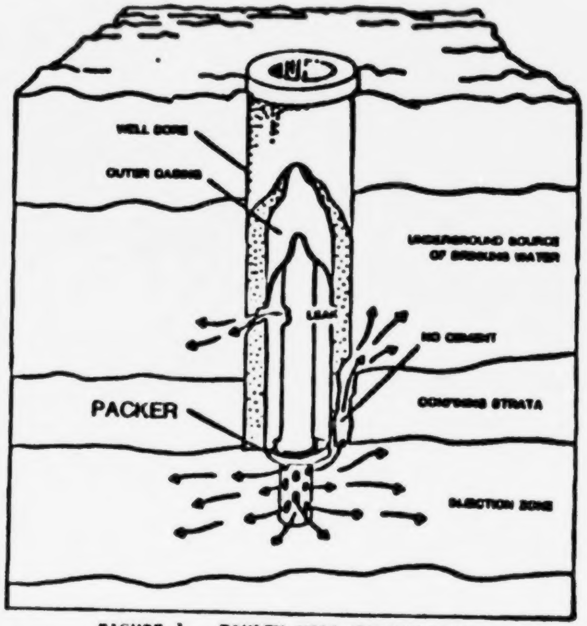


FIGURE 1. FAULTY WELL CONSTRUCTION

2. Nearby Wells

Fluids from the pressurized area in the injection zone may be forced upward through nearby wells into underground sources of drinking water, as illustrated in Figure 2.

Preventive Requirements

Wells that penetrate the injection zone in the area of review must be reviewed to assure that they are properly completed or plugged. Corrective action must be taken if they are not completed or plugged to prevent fluid migration. Newly abandoned wells must be plugged to conform with EPA procedures.

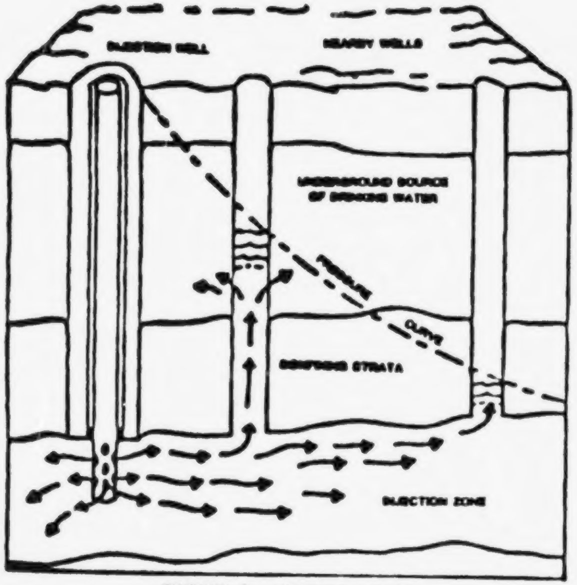

INJECTION WELL
NEARBY WELLS
UNDERGROUND SOURCE OF DRINKING WATER
PRESSURE
CURVE
CONFINING STRATA
INJECTION ZONE

FIGURE 2. NEARBY WELLS

3. Faulty or Fractured Confining Stata

Fluids may be forced upward out of the pressurized area through faults or fractures in the confining beds, as illustrated in Figure 3.

Preventive Requirements

Wells must generally be sited so that they inject below a confining bed that is free of known open faults or fractures. Injection pressure must be controlled so that fractures are not enlarged in the injection zone or created in the confining bed.

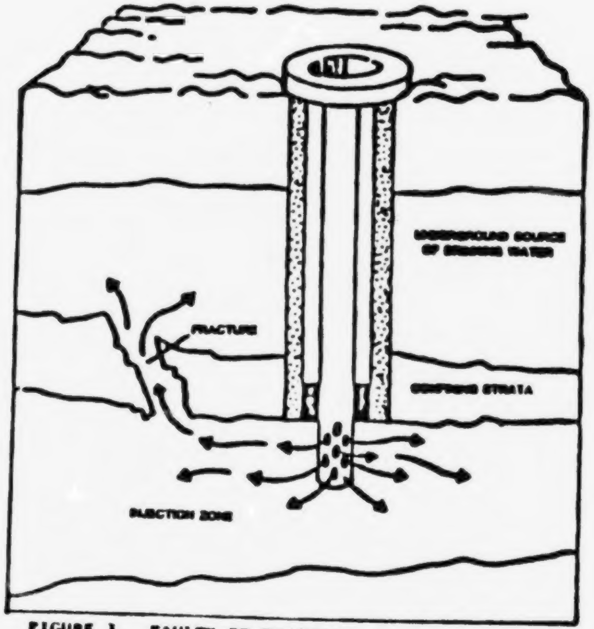

FRACTURE
UNDERGROUND SOURCE OF DRINKING WATER
CONFINING STRATA
INJECTION ZONE

FIGURE 3. FAULTY OR FRACTURED CONFINING STRATA

4. Direct Injection

Wells may be designed to inject into or above underground sources of drinking water, as illustrated in Figure 4.

Preventive Requirement

Wells injecting hazardous waste materials or radioactive waste into underground sources of drinking water are illegal. However, wells injecting hazardous wastes or radioactive wastes into exempted aquifers will not be banned. Wells that inject nonhazardous material will be regulated in the future based on recommendations to be formulated by the states.

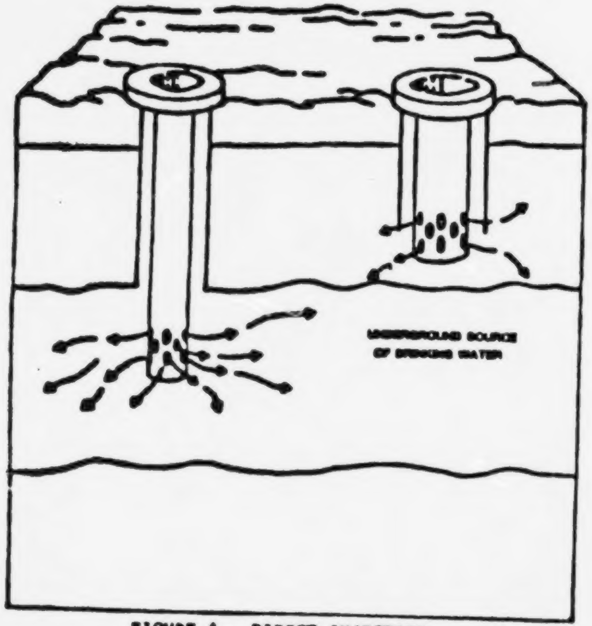

UNDERGROUND SOURCE
OF DRINKING WATER

FIGURE 4. DIRECT INJECTION

5. Lateral Displacement

Fluid may be displaced from the injection zone into hydraulically connected underground sources of drinking water, as illustrated in Figure 5.

Preventive Requirement

The proximity of injection wells to underground sources of drinking water will be considered in future siting of such wells. Well operators will be required to control injection pressure and conduct other monitoring activities to prevent the lateral migration of fluids illustrated in Figure 5.

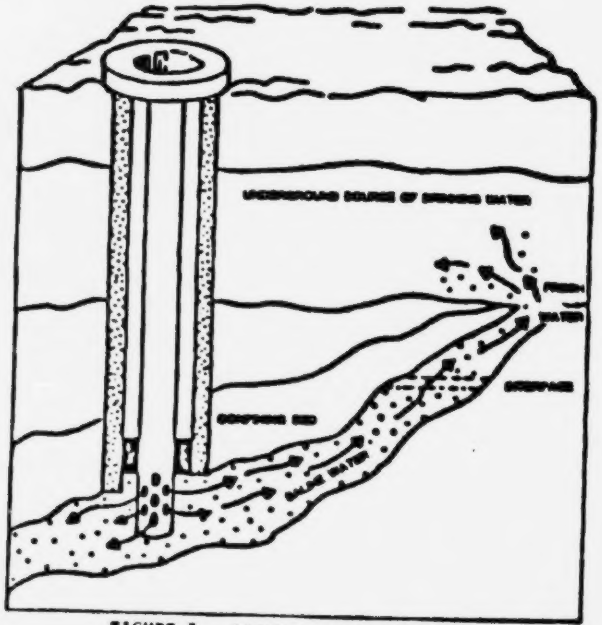

UNDERGROUND SOURCE OF DRINKING WATER
FRESH
WATER
INTERFACE
CONFINING BED
SALINE WATER

FIGURE 5. LATERAL DISPLACEMENT

Requirements for Injection Well Classes

To implement its proposed technological controls, EPA categorized well injection activities into five classes defined in Figure 6. Each class includes wells with similar functions and construction and operating features so that technical requirements can be applied consistently to the class. A brief summary of the general underground injection controls proposed for each class are highlighted in Figure 7.

FIGURE 6

FIVE CLASSES OF INJECTION WELLS

- Class I wells are those used to inject industrial, hazardous and municipal wastes beneath the deepest stratum containing an underground drinking water source.
- Class II wells are used to dispose of fluids which are brought to the surface in connection with oil and gas production, to inject fluids for the enhanced recovery of oil or gas, or to store liquid hydrocarbons.
- Class III wells are those used to inject fluids for the extraction of minerals.
- Class IV wells are those for which hazardous waste or radioactive waste are injected into or above strata that contain underground drinking water sources and those wells which inject hazardous wastes or radioactive wastes into exempted aquifers.
- Class V wells include all wells not incorporated in Classes I-IV. Typical examples of such wells are recharge wells and air conditioning return flow wells.

FIGURE 7

TYPE OF CONTROLS APPLICABLE TO INJECTION WELL CLASSES

TYPE OF CONTROL	CLASS I	CLASS II	CLASS III	CLASS IV	CLASS V
AREA OF REVIEW	Yes	New Wells Only	Yes	N/A	No
MECHANICAL INTEGRITY REQUIREMENTS	Yes	Yes	Yes	N/A	No
CONSTRUCTION REQUIREMENTS	Strict	Flexible	Moderate	Banned	To be Defined
MONITORING	Continuous	Periodic	Continuous	Varied	To be Defined
REPORTING	Quarterly	Annual	Quarterly	Quarterly	N/A
FORM OF REGULATION	By Permit	By Rule or Permit	By Permit	By Rule	By Rule

Class I

Class I wells are likely to inject potentially dangerous fluids, and will, therefore, have to meet strict construction and operating requirements.

Class I wells must inject into strata that are below the deepest underground source of drinking water and must have an adequate confining layer above the injection zone. All Class I wells must be cased and cemented to prevent fluid migration and must inject through tubing with a suitable packer set immediately above the injection zone (or an equivalent alternative).

Mechanical integrity must be demonstrated upon completion of the well and every five years thereafter, and corrective action must be taken on improperly plugged or completed wells within the area of review.

Class I well operators are required to monitor continuously the volume of disposal wastes, and well annular pressures. Class I operators must also test the composition of injected fluids periodically and provide the permitting authority with quarterly operating reports.

Sixteen Class I wells are known to exist in Indiana.

Class II

Requirements for Class II wells (those injection wells associated with oil and gas production) have been fashioned in light of the congressional mandate that the UIC regulations are not to interfere with or impede oil and gas production unless necessary to protect underground drinking water sources.

These regulations attempt to balance measures necessary for the protection of the environment against burdens imposed on the regulated community.

Class II injection wells are to have casing and cementing adequate to protect underground sources of drinking water. All Class II wells will also have to demonstrate mechanical integrity initially and every five years thereafter. However, only the applicants for new Class II permits must review nearby wells in the area of review and take corrective action on those improperly completed or plugged wells.

Operators of Class II wells are subject to limitations on the pressure and rate of injection. They must also monitor the injection pressure and volume, and the quality of the injection fluids at intervals depending on the type of operation. Annual reports to the permitting authority are required.

Two thousand, three hundred and sixty Class II wells are known to exist in Indiana.

Class III

Construction, monitoring, and reporting requirements for these wells will resemble those for Class I wells. Class III wells must be cased and cemented to prevent fluid migration. All Class III wells must comply with area of review requirements and demonstrate mechanical integrity. Class III wells will have the same monitoring requirements as Class I wells, except that more frequent monitoring will be required of drinking water supply wells adjacent to the injection sites.

No Class III wells are known to exist in Indiana.

Class IV

Existing Class IV wells used by generators of hazardous waste and radioactive waste and operators of hazardous waste management facilities which inject directly into an underground source of drinking water will be closed as soon as possible, but in no event later than six months from the effective date of the program. No new Class IV wells which inject directly into or above an underground source of drinking water will be authorized or permitted. EPA considers these wells to be a significant danger to underground drinking water sources. However, Class IV wells injecting into exempted aquifers will not be banned. EPA requirements for Class IV wells which inject above underground sources of drinking water have not been established.

Operators of Class IV wells will be required to monitor injected fluid characteristics and volumes, as required for hazardous wastes under the Resource Conservation and Recovery Act. Weekly monitoring of the impact of injections on drinking water supply wells will also be necessary. Class IV well operators must submit quarterly reports of operating results and immediate reports of changes in the characteristics of water supply wells in the vicinity of Class IV wells.

No Class IV wells are known to exist in Indiana.

Class V

At present EPA has too little information on the extent, operation, and impact of Class V wells to propose a suitable regulatory approach. The regulations, therefore, require an

regulations, therefore, require an inventory and an assessment of such wells in each state. Specific regulatory requirements will be fashioned after the completion of the assessments.

EPA will take immediate action on any Class V well that poses a significant risk to human health.

Between sixty and one hundred and fifty Class V wells are known to exist in Indiana.

III. PERMITS AND RULES - TOOLS FOR REGULATION

Under the Act, EPA has the discretion to specify whether the minimum national requirements are to be applied through rules or permits. A rule is a law, ordinance or regulation that sets forth the standards and conditions under which an activity may be conducted. A permit is a specific authorization to an individual to carry on an activity under the conditions and limitations specified in the permit.

Each method of control is appropriate in certain situations. Although the requirements imposed are equally enforceable under either method, permits are generally considered to make possible a greater degree of control. On the other hand, permits need more time and resources since they require: (1) the individual to file an application containing information about his proposed activity; (2) the effective participation of the public in the review process; and (3) EPA personnel to review, write and process each permit.

Who Must Obtain a Permit

Owners/operators of Class I, Class II (except existing enhanced recovery and existing liquid hydrocarbon storage), and Class III wells must obtain a permit to inject. New wells (those that begin to inject after the effective date of a program in a state) must be authorized by a permit before injection may begin. For existing wells, the permitting authority (EPA) will develop a schedule not to exceed five years, based on appropriate priorities, for issuing or reissuing the permits. Until the application of the owner/operator of an existing well has been processed, the injection may be authorized by rule.

A permit may be sought either for an individual well or for a group of wells in an area. An area permit may be issued for a group of wells if they are:

- Used to inject other than hazardous waste.
- Under the control of a single individual.
- Within a single field, project or site within a state.
- Of the same type and construction.
- Injecting into the same aquifer or zone.

Under an area permit, additional wells that meet the above criteria may be authorized administratively by the permitting authority.

Who May Be Authorized By Rule

Class II existing enhanced recovery and existing liquid hydrocarbon storage wells, may be authorized by rule for the

life of the well. New Class IV wells injecting into or above underground sources of drinking water are banned. Existing Class IV wells injecting into underground sources of drinking water may be authorized by rule until they are closed but in no case for more than six months after the effective date of the program. Class V wells may be authorized by rule until such a time as further regulations are issued by EPA. All of these rules must apply the requirements specified for the appropriate well class in the UIC regulations.

As mentioned above, owners/operators of existing wells waiting to file their applications and have them processed may be authorized to inject by rule in the interim. Such rules must incorporate the appropriate monitoring, reporting and abandonment requirements for each well class.

Finally, in the case of imminent and substantial hazard to human health or the environment, or if substantial and irretrievable loss of oil and gas resources will occur, injection not otherwise authorized may be desirable. In such cases, a temporary authorization to inject may be granted administratively, subject to certain limitations.

Basic Permit Requirements

Class I and Class V permits may be issued for up to ten years. Class II and Class III wells may be issued for the life of the well. However, each Class II and Class III permit will be reviewed at least once every five years. Duration of Class IV permits have not yet been established.

Each permit must be enforceable in the jurisdiction in which it is issued. It must specify construction, abandonment, operating, monitoring and reporting requirements appropriate to the well class. In addition, permits must incorporate appropriate compliance schedules if any corrective action is to be taken by the well owner/operator. Finally, permits must authorize the right of the permitting authority to have access to the well and the related records to assure compliance with permit terms.

How to Obtain a Permit

Applications for new injection wells should be filed with EPA in time to allow for the review and issuance of the permit prior to construction. Applications for existing wells will be filed according to the schedule established in each state, but in no case later than four years after the effective date of the program.

UIC permits for Indiana will be issued by EPA Region V headquarters in Chicago (see Appendix A). Permit applications must be signed by a policy level officer of the company except in the case of Class II wells where applications may be made by individuals authorized by their companies in writing to do so. Applications must contain a statement that the signing official has satisfied himself that the information provided is correct.

The information that must be available to EPA is specified for each well class in CFR Part 146. Generally, such information should include the surface and subterranean features of the injection area, the location of underground sources of drinking water in the vicinity, the results of tests in the proposed injection formation, construction features of the well, and the nature of the proposed injection operation. Contact with EPA should be made early in the project to obtain the necessary forms and information. EPA can also provide guidance on appropriate sources of information necessary to complete the application.

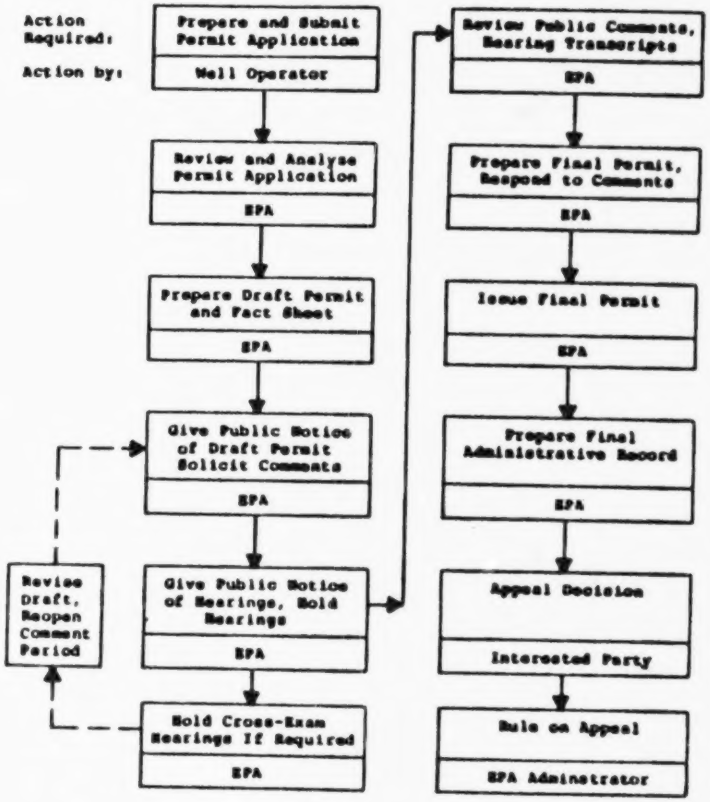
The review of a permit application begins with the receipt of a complete application by EPA. The EPA considers the application, gathers such additional information as it needs, and prepares a draft permit. The draft permit must be presented for public comment for at least 30 days with a fact sheet that provides enough information that the public can make informed judgments about the proposed action. If there is sufficient interest, a public hearing will be held and announced at least 30 days in advance.

Public comments must be taken into account in preparing the final permit, and the EPA will prepare a summary of the comments and its responses to them. A final permit is then prepared and issued. Figure 8 presents a schematic summary of the process.

First, EPA will also prepare an administrative record that documents its decision making for both the draft and final permit. Second, if sufficient interest is expressed, EPA may, after a public hearing, hold a further hearing with an opportunity for cross examination. Third, if sufficient new information becomes available during the public comment period, EPA may prepare a revised draft permit and solicit further public comment. A final EPA permit does not become effective for 30 days after it is issued. During that time, a permit may be appealed. Appeals will be considered in an established EPA process.

FIGURE 8

THE UIC PERMIT PROCESS


Action Required:
Action by:
Prepare and Submit Permit Application
Well Operator
Review and Analyze Permit Application
EPA
Prepare Draft Permit and Fact Sheet
EPA
Give Public Notice of Draft Permit Solicit Comments
EPA
Give Public Notice of Hearings, Hold Hearings
EPA
Hold Cross-Exam Hearings If Required
EPA
Revise Draft, Reopen Comment Period
Review Public Comments, Hearing Transcripts
EPA
Prepare Final Permit, Respond to Comments
EPA
Issue Final Permit
EPA
Prepare Final Administrative Record
EPA
Appeal Decision
Interested Party
Rule on Appeal
EPA Adminstrator

IV. STATE INVOLVEMENT IN UNDERGROUND INJECTION CONTROL

The Safe Drinking Water Act clearly intends the states to have the primary responsibility (primacy) for developing and implementing UIC programs. In fashioning these regulations, EPA has attempted to encourage states to assume primary responsibility (primacy).

Primacy states must have the authority to regulate injection wells at Federal facilities within the state. Injection on Indian lands, however, will remain a Federal responsibility if the state does not have adequate authority.

The State of Indiana has not submitted an approvable UIC program to EPA. Therefore, the Safe Drinking Water Act mandates EPA to establish and run a UIC program in Indiana. The Indiana Stream Pollution Control Board, in conjunction with the Indiana State Board of Health and the Department of Natural Resources, through state law, conduct regulatory programs similar to the EPA UIC program. The Indiana Stream Pollution Control Board regulates all discharges to ground water (except those related to oil and gas production) by the issuance of construction, operation and discharge permits. The discharge permitting program is administered by the Indiana State Board of Health through the divisions of Water Pollution Control, Land Pollution Control, Sanitary Engineering and the Public Water Supply Section. All injection, disposal and enhanced recovery wells associated with oil and gas production are regulated by the Indiana Department of Natural Resources which requires all drillers to be licensed. Injection well operators must currently comply with both state and EPA requirements although Indiana has the option of pursuing primacy for UIC at any time in the future.

V. EPA's UIC PROGRAM FOR INDIANA

All owners and operators in the State of Indiana are required to comply with the UIC regulations listed in 40 CFR Parts 124, 144 and 146 in addition to the Part 147 regulations that pertain to the particular combination of historical practices and geology unique to Indiana.

Maximum injection pressure for the State of Indiana for wells authorized by rule is calculated by the use of a simple formula, based on a fracture gradient measured in psi/ft., to assure that operations do not initiate or propogate fractures in the injection zone. A fracture gradient of 0.8 psi/ft. will be used for Indiana. Owners or operators may apply for and receive permission to operate at greater pressures by applying for a permit and demonstrating that they will not endanger a USDW.

Due to the large number of wells involved, the area of review for Class II wells will be based on a fixed radius in order to avoid considerable delay in program implementation caused by processing requests based on many formulae.

All Class I through Class V wells, with the exception of Class II wells, associated with oil and gas production, are currently regulated by the Indiana State Board of Health in conjunction with the Indiana Stream Pollution Control

Board (SPCB). Class II wells associated with oil and gas production are regulated by the Department of Natural Rsources. In addition, with promulgation of the federal program, all injection wells must comply with the Federal UIC regulations.

MATRIX OF INDIANA STATE AGENCY AUTHORITY

STATE AGENCY	STREAM POLLUTION CONTROL BOARD	INDIANA BOARD OF HEALTH	DEPARTMENT OF NATURAL RESOURCES
CLASS I			
MUNICIPAL	X	X	
INDUSTRIAL	X	X	
HAZARDOUS	X	X	
CLASS II			
STORAGE WELL			X
SALT WATER DISPOSAL			X
ENHANCED RECOVERY			X
CLASS III	X	X	
CLASS IV	X	X	
CLASS V			
AIR CONDITIONING RETURN	N		
CESSPOOLS/SEPTIC SYSTEMS	X	X	
URBAN RUNOFF WELLS	N		
DRY WELLS	Y		
RECHARGE WELLS	Y		
SALT WATER BARRIER WELLS	Y		
SAND BACKFILL	Y		
SUBSIDENCE CONTROL	Y		
RADIOACTIVE WASTE	Y		
GEOTHERMAL WELLS	Y		
IN SITU GASIFICATION	Y		

X = STATE AGENCY AUTHORITY
N = NOT REGULATED
Y = NOT KNOWN TO EXIST IN THE STATE OF INDIANA

APPENDIX A

LIST OF CONTACTS REGARDING UNDERGROUND INJECTION IN INDIANA BY WELL CLASS

EPA Region V
Ground Water Protection Branch (SWD-12)
230 South Dearborn
Chicago, IL 60604
Mark Vendl (312) 886-6195

Class I:
Indiana Stream Pollution Control Board
1330 West Michigan Street
Indianapolis, IN 46206
Virgil Bradford (317) 633-0700

Indiana State Board of Health
1330 West Michigan Street
Water Pollution Control Division
Indianapolis, IN 46206
Larry Kane (317) 633-0761

Class II:
Indiana Stream Pollution Control Board
1330 West Michigan Street
Indianapolis, IN 46206
Virgil Bradford (317) 633-0700

Indiana State Board of Health
1330 West Michigan Street
Water Pollution Control Division
Indianapolis, IN 46206
Larry Kane (317) 633-0761

Class II: Associated with oil and gas production.

Indiana Department of Natural Resources
911 State Office Building
Indianapolis, IN 46204
Homer Brown (317) 232-4055

Class III:

Indiana Stream Pollution Control Board
1330 West Michigan Street
Indianapolis, IN 46206
Virgil Bradford (317) 633-0700

Indiana State Board of Health
1330 West Michigan Street
Water Pollution Control Division
Indianapolis, IN 46206
Larry Kane (317) 633-0761

Class IV:

Indiana Stream Pollution Control Board
1330 West Michigan Street
Indianapolis, IN 46206
Virgil Bradford (317) 633-0700

Indiana State Board of Health
1330 West Michigan Street
Water Pollution Control Division
Indianapolis, IN 46206
Larry Kane (317) 633-0761

Class V:

Indiana Stream Pollution Control Board
1330 West Michigan Street
Indianapolis, IN 46206
Virgil Bradford (317) 633-0700

Indiana State Board of Health
1330 West Michigan Street
Water Pollution Control Division
Indianapolis, IN 46206
Larry Kane (317) 633-0761

ATTACHMENT E

Extraction Protocol
Waste Treatment Results for Inorganics

This attachment tabulates the data used to develop the conclusions in the report for chemical extraction and soil washing and immobilization of inorganics. The influent and effluent extraction protocol concentrations in the wastes are reported, as well as the corresponding reductions in mobility. The data are sorted by treatability group, technology group, and contaminant. Not all treatability groups have data for all technology groups.

ATTACHMENT E

BDAT FOR CONTAMINATED SOIL
Ranked by Reduction in Mobility
For Individual Treatment Technologies
Influent Extract - Effluent Extract

Page: 1
Date: 03/08/1989

Treatability Group: W10 NON-VOLATILE METALS
Process Group: CHEMICAL EXTRACTION AND SOIL WASHING

Rnk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Scale	Document Number	Test Num
1	0.9899312	159.90000		1.61000		SOIL WASHING	COPPER	SOIL	B	ORD-TS1-RT-EUQW-1	52
2	0.9878674	159.90000		1.94000		SOIL WASHING	COPPER	SOIL	B	ORD-TS1-RT-EUQW-1	58
3	0.9857497	80.70000		1.15000		SOIL WASHING	COPPER	SOIL	B	ORD-TS1-RT-EUQW-1	40
4	0.9836431	80.70000		1.32000		SOIL WASHING	COPPER	SOIL	B	ORD-TS1-RT-EUQW-1	34
5	0.9827757	80.70000		1.39000		SOIL WASHING	COPPER	SOIL	B	ORD-TS1-RT-EUQW-1	41
6	0.9811757	159.90000		3.01000		SOIL WASHING	COPPER	SOIL	B	ORD-TS1-RT-EUQW-1	46
7	0.9630597	26.80000		0.99000		SOIL WASHING	NICKEL	SOIL	B	ORD-TS1-RT-EUQW-1	52
8	0.9604477	26.80000		1.06000		SOIL WASHING	NICKEL	SOIL	B	ORD-TS1-RT-EUQW-1	58
9	0.9550500	0.89000		0.04000		SOIL WASHING	COPPER	SOIL	B	ORD-TS1-RT-EUQW-1	16
10	0.9541045	26.80000		1.23000		SOIL WASHING	NICKEL	SOIL	B	ORD-TS1-RT-EUQW-1	46
11	0.9462857	17.50000		0.94000		SOIL WASHING	NICKEL	SOIL	B	ORD-TS1-RT-EUQW-1	41
12	0.9438200	0.89000		0.05000		SOIL WASHING	COPPER	SOIL	B	ORD-TS1-RT-EUQW-1	28
13	0.9382114	159.90000		9.88000		SOIL WASHING	COPPER	SOIL	B	ORD-TS1-RT-EUQW-1	53
14	0.9344200	0.61000		0.04000		SOIL WASHING	COPPER	SOIL	B	ORD-TS1-RT-EUQW-1	4
15	0.9280000	17.50000		1.26000		SOIL WASHING	NICKEL	SOIL	B	ORD-TS1-RT-EUQW-1	34
16	0.9245714	17.50000		1.32000		SOIL WASHING	NICKEL	SOIL	B	ORD-TS1-RT-EUQW-1	40
17	0.9208178	80.70000		6.39000		SOIL WASHING	COPPER	SOIL	B	ORD-TS1-RT-EUQW-1	35
18	0.9108571	17.50000		1.56000		SOIL WASHING	NICKEL	SOIL	B	ORD-TS1-RT-EUQW-1	35
19	0.9059701	26.80000		2.52000		SOIL WASHING	NICKEL	SOIL	B	ORD-TS1-RT-EUQW-1	53
20	0.9016400	0.61000		0.06000		SOIL WASHING	COPPER	SOIL	B	ORD-TS1-RT-EUQW-1	10
21	0.9000000	0.40000		0.04000		SOIL WASHING	NICKEL	SOIL	B	ORD-TS1-RT-EUQW-1	22
22	0.8876400	0.89000		0.10000		SOIL WASHING	COPPER	SOIL	B	ORD-TS1-RT-EUQW-1	22
23	0.8876400	0.89000		0.10000		SOIL WASHING	COPPER	SOIL	B	ORD-TS1-RT-EUQW-1	23
24	0.8518500	0.27000		0.04000		SOIL WASHING	NICKEL	SOIL	B	ORD-TS1-RT-EUQW-1	4
25	0.8518500	0.27000		0.04000		SOIL WASHING	NICKEL	SOIL	B	ORD-TS1-RT-EUQW-1	10
26	0.8333000	0.06000		0.01000		SOIL WASHING	CHROMIUM	SOIL	B	ORD-TS1-RT-EUQW-1	46
27	0.8333000	0.06000		0.01000		SOIL WASHING	CHROMIUM	SOIL	B	ORD-TS1-RT-EUQW-1	52
28	0.8333000	0.06000		0.01000		SOIL WASHING	CHROMIUM	SOIL	B	ORD-TS1-RT-EUQW-1	53
29	0.8333000	0.06000		0.01000		SOIL WASHING	CHROMIUM	SOIL	B	ORD-TS1-RT-EUQW-1	58
30	0.7777800	0.27000		0.06000		SOIL WASHING	NICKEL	SOIL	B	ORD-TS1-RT-EUQW-1	11
31	0.7250000	0.40000		0.11000		SOIL WASHING	NICKEL	SOIL	B	ORD-TS1-RT-EUQW-1	23
32	0.7049200	0.61000		0.18000		SOIL WASHING	COPPER	SOIL	B	ORD-TS1-RT-EUQW-1	11
33	0.7000000	0.40000		0.12000		SOIL WASHING	NICKEL	SOIL	B	ORD-TS1-RT-EUQW-1	28
34	0.6250000	0.40000		0.15000		SOIL WASHING	NICKEL	SOIL	B	ORD-TS1-RT-EUQW-1	16

SOIL - 34 data points SLUDGE (SLUD) - 0 data points

ATTACHMENT E

BDAT FOR CONTAMINATED SOIL
Ranked by Reduction in Mobility
For Individual Treatment Technologies
Influent Extract - Effluent Extract

Page: 2
Date: 03/08/1989

Treatability Group: W10 NON-VOLATILE METALS
Process Group: IMMOBILIZATION

Rnk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Scale	Document Number	Test Num
1	0.4400000	1.00000		0.56000		STABILIZATION	CHROMIUM	SOIL	B	980-TS1-RT-FCAK-1	1
2	0.2500000	1.00000		0.75000		STABILIZATION	CHROMIUM	SOIL	B	980-TS1-RT-FCAK-1	1
3	0.2000000	1.00000		0.80000		STABILIZATION	CHROMIUM	SOIL	B	980-TS1-RT-FCAK-1	1
4	0.0700000	1.00000		0.93000		STABILIZATION	CHROMIUM	SOIL	B	980-TS1-RT-FCAK-1	1

SOIL - 4 data points SLUDGE (SLUD) - 0 data points

Rnk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Scale	Document Number	Test Num
1	0.9016400	0.61000		0.06000		CEMENT SOLIDIFICATIO	COPPER	SOIL	B	ORD-TS1-RT-FHMF-1	1
2	0.8593400	0.22750		0.03200		CEMENT SOLIDIFICATIO	COPPER	SOIL	B	980-TS1-RT-EUXT-1	1
3	0.8518500	0.27000		0.04000		CEMENT SOLIDIFICATIO	NICKEL	SOIL	B	ORD-TS1-RT-FHMF-1	1
4	0.3000000	0.05000		0.03500		CEMENT SOLIDIFICATIO	CHROMIUM	SOIL	B	980-TS1-RT-EUXT-1	1

SOIL - 4 data points SLUDGE (SLUD) - 0 data points

Rnk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Scale	Document Number	Test Num
1	0.9998850	87.00000		0.01000	ND	FLYASH SOLIDIFICATIO	NICKEL	SLUD	P	980-TS1-RT-FAAP-1	1
2	0.9998850	87.00000		0.01000	ND	FLYASH SOLIDIFICATIO	NICKEL	SLUD	P	980-TS1-RT-FAAP-1	1
3	0.9998684	76.00000		0.01000	ND	FLYASH SOLIDIFICATIO	NICKEL	SLUD	P	980-TS1-RT-FAAP-1	2
4	0.9990909	22.00000		0.02000		FLYASH SOLIDIFICATIO	CHROMIUM	SLUD	P	980-TS1-RT-FAAP-1	1
5	0.9986363	22.00000		0.03000		FLYASH SOLIDIFICATIO	CHROMIUM	SLUD	P	980-TS1-RT-FAAP-1	1
6	0.9985074	26.80000		0.04000		FLYASH SOLIDIFICATIO	NICKEL	SOIL	B	ORD-TS1-RT-FHMF-1	2
7	0.9980263	76.00000		0.15000		FLYASH SOLIDIFICATIO	NICKEL	SLUD	P	980-TS1-RT-FAAP-1	2
8	0.9895560	159.90000		1.67000		FLYASH SOLIDIFICATIO	COPPER	SOIL	B	ORD-TS1-RT-FHMF-1	2
9	0.9800000	3.50000		0.07000		FLYASH SOLIDIFICATIO	CHROMIUM	SLUD	P	980-TS1-RT-FAAP-1	2
10	0.9800000	3.50000		0.07000		FLYASH SOLIDIFICATIO	CHROMIUM	SLUD	P	980-TS1-RT-FAAP-1	2
11	0.9662900	0.89000		0.03000		FLYASH SOLIDIFICATIO	COPPER	SOIL	B	ORD-TS1-RT-FHMF-1	5
12	0.9000000	0.40000		0.04000		FLYASH SOLIDIFICATIO	NICKEL	SOIL	B	ORD-TS1-RT-FHMF-1	4
13	0.9000000	0.40000		0.04000		FLYASH SOLIDIFICATIO	NICKEL	SOIL	B	ORD-TS1-RT-FHMF-1	5
14	0.8988700	0.89000		0.09000		FLYASH SOLIDIFICATIO	COPPER	SOIL	B	ORD-TS1-RT-FHMF-1	4

SOIL - 6 data points SLUDGE (SLUD) - 8 data points

Rnk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Scale	Document Number	Test Num
1	0.9971428	17.50000		0.05000		CARBONATE IMMOBILIZA	NICKEL	SOIL	B	ORD-TS1-RT-FHMF-1	3
2	0.9679058	80.70000		2.59000		CARBONATE IMMOBILIZA	COPPER	SOIL	B	ORD-TS1-RT-FHMF-1	1

SOIL - 2 data points SLUDGE (SLUD) - 0 data points

ATTACHMENT E

BDAT FOR CONTAMINATED SOIL
Ranked by Reduction in Mobility
For Individual Treatment Technologies
Influent Extract - Effluent Extract

Page: 3
Date: 03/08/1989

Treatability Group: W11 VOLATILE METALS
Process Group: CHEMICAL EXTRACTION AND SOIL WASHING

Rnk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Scale	Document Number	Test Num
1	0.9950284	70.40000		0.35000		SOIL WASHING	LEAD	SOIL	B	ORD-TS1-RT-EUQW-1	46
2	0.9943182	70.40000		0.40000		SOIL WASHING	LEAD	SOIL	B	ORD-TS1-RT-EUQW-1	52
3	0.9928977	70.40000		0.50000		SOIL WASHING	LEAD	SOIL	B	ORD-TS1-RT-EUQW-1	58
4	0.9924657	14.60000		0.11000		SOIL WASHING	ZINC	SOIL	B	ORD-TS1-RT-EUQW-1	28
5	0.9712329	14.60000		0.42000		SOIL WASHING	ZINC	SOIL	B	ORD-TS1-RT-EUQW-1	22
6	0.9678082	14.60000		0.47000		SOIL WASHING	ZINC	SOIL	B	ORD-TS1-RT-EUQW-1	16
7	0.9589000	0.73000		0.03000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TS1-RT-EUQW-1	28
8	0.9541076	35.30000		1.62000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TS1-RT-EUQW-1	52
9	0.9486301	14.60000		0.75000		SOIL WASHING	ZINC	SOIL	B	ORD-TS1-RT-EUQW-1	23
10	0.9350453	33.10000		2.15000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TS1-RT-EUQW-1	41
11	0.9348011	70.40000		4.59000		SOIL WASHING	LEAD	SOIL	B	ORD-TS1-RT-EUQW-1	53
12	0.9315000	0.73000		0.05000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TS1-RT-EUQW-1	22
13	0.9315000	0.73000		0.05000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TS1-RT-EUQW-1	23
14	0.9252441	358.50000		26.80000		SOIL WASHING	ZINC	SOIL	B	ORD-TS1-RT-EUQW-1	41
15	0.9217120	9.58000		0.75000		SOIL WASHING	ARSENIC	SOIL	B	ORD-TS1-RT-EUQW-1	52
16	0.9216080	19.90000		1.56000		SOIL WASHING	LEAD	SOIL	B	ORD-TS1-RT-EUQW-1	41
17	0.9155807	35.30000		2.98000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TS1-RT-EUQW-1	46
18	0.9142800	0.70000		0.06000		SOIL WASHING	LEAD	SOIL	B	ORD-TS1-RT-EUQW-1	16
19	0.9139280	6.39000		0.55000		SOIL WASHING	ARSENIC	SOIL	B	ORD-TS1-RT-EUQW-1	41
20	0.9076080	9.20000		0.85000		SOIL WASHING	ZINC	SOIL	B	ORD-TS1-RT-EUQW-1	10
21	0.9043480	9.20000		0.88000		SOIL WASHING	ZINC	SOIL	B	ORD-TS1-RT-EUQW-1	4
22	0.9041100	0.73000		0.07000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TS1-RT-EUQW-1	16
23	0.9021740	9.20000		0.90000		SOIL WASHING	ZINC	SOIL	B	ORD-TS1-RT-EUQW-1	11
24	0.9018790	9.58000		0.94000		SOIL WASHING	ARSENIC	SOIL	B	ORD-TS1-RT-EUQW-1	46
25	0.8998430	6.39000		0.64000		SOIL WASHING	ARSENIC	SOIL	B	ORD-TS1-RT-EUQW-1	40
26	0.8987470	9.58000		0.97000		SOIL WASHING	ARSENIC	SOIL	B	ORD-TS1-RT-EUQW-1	58
27	0.8964385	395.90000		41.00000		SOIL WASHING	ZINC	SOIL	B	ORD-TS1-RT-EUQW-1	52
28	0.8926497	395.90000		42.50000		SOIL WASHING	ZINC	SOIL	B	ORD-TS1-RT-EUQW-1	58
29	0.8891238	33.10000		3.67000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TS1-RT-EUQW-1	40
30	0.8711297	358.50000		46.20000		SOIL WASHING	ZINC	SOIL	B	ORD-TS1-RT-EUQW-1	40
31	0.8654150	6.39000		0.86000		SOIL WASHING	ARSENIC	SOIL	B	ORD-TS1-RT-EUQW-1	34
32	0.8620396	35.30000		4.87000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TS1-RT-EUQW-1	58
33	0.8605300	358.50000		50.00000		SOIL WASHING	ZINC	SOIL	B	ORD-TS1-RT-EUQW-1	34
34	0.8524407	358.50000		52.90000		SOIL WASHING	ZINC	SOIL	B	ORD-TS1-RT-EUQW-1	35
35	0.8504532	33.10000		4.95000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TS1-RT-EUQW-1	34
36	0.8430595	35.30000		5.54000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TS1-RT-EUQW-1	53
37	0.8006260	9.58000		1.91000		SOIL WASHING	ARSENIC	SOIL	B	ORD-TS1-RT-EUQW-1	53
38	0.8002021	395.90000		79.10000		SOIL WASHING	ZINC	SOIL	B	ORD-TS1-RT-EUQW-1	46
39	0.7857100	0.70000		0.15000		SOIL WASHING	LEAD	SOIL	B	ORD-TS1-RT-EUQW-1	22
40	0.7857100	0.70000		0.15000		SOIL WASHING	LEAD	SOIL	B	ORD-TS1-RT-EUQW-1	23
41	0.7857100	0.70000		0.15000		SOIL WASHING	LEAD	SOIL	B	ORD-TS1-RT-EUQW-1	28

ATTACHMENT E

BDAT FOR CONTAMINATED SOIL
Ranked by Reduction in Mobility
For Individual Treatment Technologies
Influent Extract - Effluent Extract

Page: 4
Date: 03/08/1989

Treatability Group: W11 VOLATILE METALS
Process Group: CHEMICAL EXTRACTION AND SOIL WASHING

Rnk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Scale	Document Number	Test Num
42	0.7735800	0.53000		0.12000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TS1-RT-EUQW-1	10
43	0.7646525	33.10000		7.79000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TS1-RT-EUQW-1	35
44	0.7351759	19.90000		5.27000		SOIL WASHING	LEAD	SOIL	B	ORD-TS1-RT-EUQW-1	40
45	0.7261340	6.39000		1.75000		SOIL WASHING	ARSENIC	SOIL	B	ORD-TS1-RT-EUQW-1	35
46	0.7169800	0.53000		0.15000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TS1-RT-EUQW-1	4
47	0.6938800	0.49000		0.15000		SOIL WASHING	LEAD	SOIL	B	ORD-TS1-RT-EUQW-1	4
48	0.6938800	0.49000		0.15000		SOIL WASHING	LEAD	SOIL	B	ORD-TS1-RT-EUQW-1	10
49	0.6938800	0.49000		0.15000		SOIL WASHING	LEAD	SOIL	B	ORD-TS1-RT-EUQW-1	11
50	0.6753769	19.90000		6.46000		SOIL WASHING	LEAD	SOIL	B	ORD-TS1-RT-EUQW-1	34
51	0.6666600	0.15000		0.05000		SOIL WASHING	ARSENIC	SOIL	B	ORD-TS1-RT-EUQW-1	10
52	0.6542056	395.90000		136.90000		SOIL WASHING	ZINC	SOIL	B	ORD-TS1-RT-EUQW-1	53
53	0.5094300	0.53000		0.26000		SOIL WASHING	CADMIUM	SOIL	B	ORD-TS1-RT-EUQW-1	11
54	0.4135678	19.90000		11.67000		SOIL WASHING	LEAD	SOIL	B	ORD-TS1-RT-EUQW-1	35

SOIL - 54 data points SLUDGE (SLUD) - 0 data points

ATTACHMENT E

BDAT FOR CONTAMINATED SOIL
Ranked by Reduction in Mobility
For Individual Treatment Technologies
Influent Extract - Effluent Extract

Page: 5
Date: 03/08/1989

Treatability Group: W11 VOLATILE METALS
Process Group: IMMOBILIZATION

Rnk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Scale	Document Number	Test Num
1	0.9998226	6200.00000		1.10000		STABILIZATION	LEAD	SOIL	B	980-TS1-RT-FCAK-2	1
2	0.9997742	6200.00000		1.40000		STABILIZATION	LEAD	SOIL	B	980-TS1-RT-FCAK-2	1
3	0.9995161	6200.00000		3.00000		STABILIZATION	LEAD	SOIL	B	980-TS1-RT-FCAK-2	1
4	0.9993865	16.30000		0.01000		STABILIZATION	LEAD	SOIL	B	980-TS1-RT-FCAK-3	1
5	0.9989899	59.40000		0.06000	ND	STABILIZATION	LEAD	SOIL	B	980-TS1-RT-EURY-1	1
6	0.9989899	59.40000		0.06000	ND	STABILIZATION	LEAD	SOIL	B	980-TS1-RT-EURY-1	1
7	0.9987730	16.30000		0.02000		STABILIZATION	LEAD	SOIL	B	980-TS1-RT-FCAK-3	1
8	0.9985690	59.40000		0.08500		STABILIZATION	LEAD	SOIL	B	980-TS1-RT-EURY-1	1
9	0.9950920	16.30000		0.08000		STABILIZATION	LEAD	SOIL	B	980-TS1-RT-FCAK-3	1
10	0.9901840	16.30000		0.16000		STABILIZATION	LEAD	SOIL	B	980-TS1-RT-FCAK-3	1
11	0.9489790	9.80000		0.50000		STABILIZATION	LEAD	SOIL	B	980-TS1-RT-FCAK-1	1
12	0.9489790	9.80000		0.50000		STABILIZATION	LEAD	SOIL	B	980-TS1-RT-FCAK-1	1
13	0.7959180	9.80000		2.00000		STABILIZATION	LEAD	SOIL	B	980-TS1-RT-FCAK-1	1
14	0.6326530	9.80000		3.60000		STABILIZATION	LEAD	SOIL	B	980-TS1-RT-FCAK-1	1

SOIL - 14 data points SLUDGE (SLUD) - 0 data points

Rnk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Scale	Document Number	Test Num
1	0.9996808	123.70000		0.03850		CEMENT SOLIDIFICATIO	ZINC	SOIL	B	980-TS1-RT-EUXT-1	1
2	0.9987206	12.11500		0.01550		CEMENT SOLIDIFICATIO	LEAD	SOIL	B	980-TS1-RT-EUXT-1	1
3	0.9811300	0.53000		0.01000		CEMENT SOLIDIFICATIO	CADMIUM	SOIL	B	ORD-TS1-RT-FHMF-1	1
4	0.9765000	0.01700		0.00040		CEMENT SOLIDIFICATIO	CADMIUM	SOIL	B	980-TS1-RT-EUXT-1	1
5	0.9467390	9.20000		0.49000		CEMENT SOLIDIFICATIO	ZINC	SOIL	B	ORD-TS1-RT-FHMF-1	1
6	0.6938800	0.49000		0.15000		CEMENT SOLIDIFICATIO	LEAD	SOIL	B	ORD-TS1-RT-FHMF-1	1

SOIL - 6 data points SLUDGE (SLUD) - 0 data points

Rnk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Scale	Document Number	Test Num
1	0.9997167	35.30000		0.01000		FLYASH SOLIDIFICATIO	CADMIUM	SOIL	B	ORD-TS1-RT-FHMF-1	2
2	0.9986301	14.60000		0.02000		FLYASH SOLIDIFICATIO	ZINC	SOIL	B	ORD-TS1-RT-FHMF-1	5
3	0.9904774	395.90000		3.77000		FLYASH SOLIDIFICATIO	ZINC	SOIL	B	ORD-TS1-RT-FHMF-1	2
4	0.9863000	0.73000		0.01000		FLYASH SOLIDIFICATIO	CADMIUM	SOIL	B	ORD-TS1-RT-FHMF-1	4
5	0.9863000	0.73000		0.01000		FLYASH SOLIDIFICATIO	CADMIUM	SOIL	B	ORD-TS1-RT-FHMF-1	5
6	0.9718160	9.58000		0.27000		FLYASH SOLIDIFICATIO	ARSENIC	SOIL	B	ORD-TS1-RT-FHMF-1	2
7	0.9465753	14.60000		0.78000		FLYASH SOLIDIFICATIO	ZINC	SOIL	B	ORD-TS1-RT-FHMF-1	4
8	0.7857100	0.70000		0.15000		FLYASH SOLIDIFICATIO	LEAD	SOIL	B	ORD-TS1-RT-FHMF-1	5
9	0.6960227	70.40000		21.40000		FLYASH SOLIDIFICATIO	LEAD	SOIL	B	ORD-TS1-RT-FHMF-1	2
10	0.4714300	0.70000		0.37000		FLYASH SOLIDIFICATIO	LEAD	SOIL	B	ORD-TS1-RT-FHMF-1	4

SOIL - 10 data points SLUDGE (SLUD) - 0 data points

ATTACHMENT E

BDAT FOR CONTAMINATED SOIL
Ranked by Reduction in Mobility
For Individual Treatment Technologies
Influent Extract - Effluent Extract

Page: 6
Date: 03/08/1989

Treatability Group: W11 VOLATILE METALS
Process Group: IMMOBILIZATION

Rnk	Mobility Reduction	Influent Concen (PPM)	Qul Inf	Effluent Concen (PPM)	Qul Eff	Process Description	Contaminant Name	Media	Scale	Document Number	Test Num
1	0.9993958	33.10000		0.02000		CARBONATE IMMOBILIZA	CADMIUM	SOIL	B	ORD-TSI-RT-FHMF-1	3
2	0.9889261	358.50000		3.97000		CARBONATE IMMOBILIZA	ZINC	SOIL	B	ORD-TSI-RT-FHMF-1	3
3	0.8763690	6.39000		0.79000		CARBONATE IMMOBILIZA	ARSENIC	SOIL	B	ORD-TSI-RT-FHMF-1	3

SOIL - 3 data points SLUDGE (SLUD) - 0 data points

ADMINISTRATIVE RECORD INDEX - UPDATE
MIDCO II
GARY, INDIANA

ME/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBE
	1	85/11/05	Requirement that the 10-foot monitoring well in cluster E at the site be replaced.	Rich Boice-USEPA	Robert Aten-Geosciences	Correspondence	1
	1	85/11/14	Recommendation that a 90-foot monitoring well be installed on the north or northeast of the site to check for a deep sand aquifer.	Rich Boice-USEPA	Robert Aten-Geosciences	Correspondence	2
	1	86/03/13	Documentation of a 3/11/86 phone reaching agreement that a clay cover on the test pits is unnecessary.	Robert Aten-Geosciences	Rich Boice-USEPA	Correspondence	3
	1	86/04/11	Revised schedule for deliverables.	Robert Aten-Geosciences	Rich Boice-USEPA	Correspondence	4
	1	86/05/16	Phase II groundwater samples collected for metal analysis will be filtered.	Robert Aten-Geosciences	Rich Boice-USEPA	Correspondence	5
	39	86/05/19	Letter and table reflecting changes in the treatment of groundwater samples for metals.	James Keith-Geosciences	Rich Boice-USEPA	Correspondence	6
	1	86/06/03	Documentation of a phone call where a request by Geosciences for a reduction of the Phase II groundwater parameter list was denied by Boice of the USEPA.	Robert Aten-GeosciencesResearchAsso	Richard Boice-USEPA	Correspondence	7
	7	86/06/18	Because of rapid recovery of the wells during slug tests, transducers will be used to record recovery and a pneumatic method used to record water levels. Also, a detailed aquifer pump test will be performed.	Robert Aten-Geosciences	Rich Boice-USEPA	Correspondence	8
	3	86/06/24	List outlining status of tape downs conducted during	Robbin Lee Zeff-Geosciences	Rich Boice-USEPA	Correspondence	9

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CHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
			residential well sampling.				
	10	86/07/23	Revised schedules for completing work.	Robert Aten-Geosciences	Rich Boice-USEPA	Correspondence	10
	2	87/01/07	Final revisions required in the Midco II RI.	Rich Boice-USEPA	Roy Ball-ERM	Correspondence	11
	7	87/01/08	Comments on Array of Alternatives documents.	Rich Boice-USEPA	Roy Ball - ERM	Correspondence	12
	10	87/01/13	Review of Midco I & II RI Reports.	K.W.Brown-Texas A&M University	Rich Boice-USEPA	Correspondence	13
	17	87/01/15	Review comments on the Midco I & II RI Reports.	David Homer-PRC	Rich Boice-USEPA	Correspondence	14
	43	87/01/16	Review and analysis of the first drafts of the Midco I and II RI Reports.	Donald Smith-Pratt&Lambert,Tech. Com	Rich Boice-USEPA	Correspondence	15
	6	87/01/29	Review and written comments on the Draft Midco II RI Report dated 12/2/86.	David Hudak-U.S. Dept. of Interior	Rich Boice-USEPA	Correspondence	16
	3	87/03/06	Determination that additional sampling, analyses and evaluation are necessary.	Basil Constantelos-USEPA	Olian,Klettke,Barker	Correspondence	17
	3	87/03/13	Comments on Midco I and II Draft Remedial Investigations Reports.	Reginald Baker-IDEM	Rich Boice-USEPA	Correspondence	18
	3	87/04/13	Midco I and Midco II Progress Reports.	Arthur Slesinger-Morton Thiokol	Rich Boice-USEPA	Correspondence	19
	2	87/04/17	Proposed area for the soil gas survey as an extension of the Midco II remedial investigation.	Robert Aten-Geosciences	Robert Hess, Hammond, IN	Correspondence	20
	07	87/05/05	Installation of new monitoring wells at Midco II.	Robert Aten-Geosciences	Rich Boice-USEPA	Correspondence	21
	1	87/05/29	Midco II soil gas study.	Robert Aten-Geosciences	Rich Boice-USEPA	Correspondence	22
	1	87/05/29	Midco II, ground water, surface water and surface sediment sampling activities.	Robert Aten-Geosciences	Rich Boice-USEPA	Correspondence	23

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ICHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
	2	87/07/21	Concerns over the third round of sampling.	Rich Boice-USEPA	Roy Ball-ERM	Correspondence	24
	3	87/08/19	Letter attempting resolution of RI/FS issues.	Rich Boice-USEPA	Roy Ball-ERM	Correspondence	25
	15	87/09/03	Comments on the final RI.	K.W.Brown-KWB&A Env.Consultants	Rich Boice-USEPA	Correspondence	26
	2	87/09/18	Clarification of the United State's position that the development of the remedial action alternatives is a technical task based on an objective evaluation of those remedial actions which are most conducive to minimizing or mitigating the threat to public health, welfare or the environment.	Joel Gross- U.S. DOJ	R.Olian-Sidley & Austin	Correspondence	27
	18	87/09/22	Technical review comments on the Remedial Options Documents.	Kurt Stimpson-Roy F. Weston	Rich Boice-USEPA	Correspondence	28
	9	87/09/29	Comments on the draft preliminary list of remedial technologies and final comments on the RI.	Rich Boice-USEPA	Roy Ball-ERM	Correspondence	29
	2	87/12/08	Corrections and revisions to the final RI.	Rich Boice-USEPA	Roy Ball-ERM	Correspondence	30
	1	87/12/17	Review of the RI.	Dave Homer-PRC	Rich Boice-USEPA	Correspondence	31
	2	87/12/29	Comments on Feasibility Study.	Dave Homer-PRC	Rich Boice-USEPA	Correspondence	32
	5	88/01/06	Comments on the FS ARAR's.	Kurt Stimpson-Roy F. Weston,Inc.	Rich Boice-USEPA	Correspondence	33
	14	88/01/12	Ground Water Contribution to Surface Water Concentrations at the Midco Site.	Blaie Millano-ERM	Rich Boice-USEPA	Correspondence	34
	2	88/05/17	Review of Progress Report No. 34.	Rich Boice-USEPA	Roy Ball-ERM	Correspondence	35

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	9	88/07/06	Comments on the FS.	Dave Homer-PRC	Rich Boice-USEPA	Correspondence	36
	22	88/07/07	Review of the FS and Dissipation of Groundwater Contaminants.	Frederick Test-Roy. F. Weston,Inc.	Rich Boice-USEPA	Correspondence	37
	43	88/07/17	Review of Midco II draft FS.	Rich Boice-USEPA	Roy Ball-ERM	Correspondence	38
	9	88/08/25	Comments on new alternatives requested by the USEPA for the FS.	Roy Ball-ERM	Rich Boice-USEPA	Correspondence	39
	3	88/09/29	Preliminary review of the QAPP for the solidification tests.	Rich Boice-USEPA	Roy Ball-ERM	Correspondence	40
	6	88/09/30	Review of cleanup action levels for Midco II.	Dave Homer-PRC	Rich Boice-USEPA	Correspondence	41
	4	88/10/07	Review of the QAPP for the solidifcation tests.	Rich Boice-USEPA	Roy Ball-ERM	Correspondence	42
	5	88/10/14	Technical review of cleanup action levels for Midco II.	Frederick Test-Roy F. Weston, Inc.	Rich Boice-USEPA	Correspondence	43
	10	88/10/31	Additional Indiana Air Pollution Regulations for Indiana ARAR's.	Reginald Baker-IDEM	Karen Vaughn-Dames&Moore	Correspondence	44
	9	88/11/11	Tecnical review of revised draft FS.	Frederick Test-Roy F. Weston,Inc.	Rich Boice-USEPA	Correspondence	45
	6	88/11/18	Review of Appendices A & D in the FS's for Midco I & II.	David Homer-PRC	Rich Boice-USEPA	Correspondence	46
	4	88/12/02	Revisions and additions to the FS.	Rich Boice-USEPA	Roy Ball-Env.Resouce Mgmt	Correspondence	47
	5	89/01/03	Clarification of the criteria that will be used to evaluate the effectiveness of in-situ vapor extraction followed by in-situ solidification/ stabilization.	James Mayka-USEPA	Roy Ball-ERM	Correspondence	48

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	5	89/01/23	Review comments on the Midco I and II FS.	Rich Boice-USEPA	Karen Vaughn-Dames&Moore	Correspondence	49
	5	89/01/26	Review of 1/13/89 Editions of Midco I and II Feasibility Studies by PRC Env.Mgmt.	Richard Boice-USEPA	Dames&Moore & EnvResource	Correspondence	50
	1	89/01/27	Technical review of the FS.	Frederick Test-Roy F. Weston	Rich Boice-USEPA	Correspondence	51
	1	89/02/13	Letter stating that if wastes are excavated, mixed with reagents and then placed back on the site, then landban regulations may be applicable.	James Mayka-USEPA	Roy Ball-ERM	Correspondence	52
	4	85/06/19	"EPA Announces Agreement On Midco I & II Sites In Gary"	USEPA		Fact Sheet	53
	2	85/07/00	"EPA Announces Midco II Work Plan"	USEPA		Fact Sheet	54
	3	87/11/00	"Midco I & II Remedial Investigation Update November 1987"	USEPA		Fact Sheet	55
	2	88/00/00	"Midco I & II Remedial Investigation Update Winter 1988"	USEPA		Fact Sheet	56
	2	88/12/00	"Midco I & II Remedial Investigation Update"	USEPA		Fact Sheet	57
	3	00/00/00	List of site visits to 3/8/83.	Bevely Kush-USEPA	Karen Waldvogel-USEPA	Memorandum	58
	5	79/08/07	Reconnaisance inspection of Midco I and II on 8/2/79.	Eugene Meyer - USEPA	Jay Goldstein-USEPA	Memorandum	59
	7	80/12/01	Report of site activities in late 1980.	Mike McCarrin-Ecol. & Envir.	File	Memorandum	60
	5	83/06/02	Report on site inspection.	C.F.Bieze-Ecol. & Envir.	File	Memorandum	61
	2	83/08/04	List of site visits to 10/5/82.	Alan Baumann-USEPA	Karen Waldvogel-USEPA	Memorandum	62

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	3	83/08/10	Trip Report on site visit.	Dave Homer-PRC	File	Memorandum	63
	2	86/03/20	Midco II Groundwater Sampling Phase I-summary of operations.	Robert Aten - Geosciences	Rich Boice-USEPA	Memorandum	64
	3	86/06/06	Trip Report,PRP Audit/Training-Geosciences Research Assoc.-May 13-15, 1986.	Wesolowski & Churilla-USEPA	Files	Memorandum	65
	6	86/06/16	Response to comments made by Jay Thakkar, Dennis Wesolowski and Patrick Churilla regarding contract laboratory analysis.	James Kieth-Geosciences	Robert Aten-Geosciences	Memorandum	66
	2	86/09/05	Midco Slug Test Computations.	John Bassett-Geosciences	Robert Aten-Geosciences	Memorandum	67
	2	87/01/14	Review comments on Remedial Investigation Reports Completed in Nov. and Dec. 1986 - Midco I & II.	C.Kurt Lamber-USEPA OWPE	Linda Cooper-USEPA OWPE	Memorandum	68
	3	87/01/21	Review of Midco I and II sites using Ground Water Classification Guidelines.	Charles Sutfin-USEPA	Basil Constantelos-USEPA	Memorandum	69
	4	87/01/28	Review of Midco II RI Report dated 12/2/86.	James Wheat-IDEM	Jayne Browning-IDEM	Memorandum	70
	7	87/01/29	Documentation of Midco I and II RI Review meeting.	Carole Wolff-Weston	Kurt Stimpson-Weston	Memorandum	71
	5	87/02/20	Additional Sediment Sampling at Midco II - Attachment No. 1.	Kurt Stimpson-Roy F. Weston,Inc.	Rich Boice	Memorandum	72
	9	87/12/03	ACTION MEMORANDUM-Ceiling Increase Request for the Removal Action at the Midco II Site,Gary,Indiana.	Valdas Adamkus-USEPA	J.Winston Porter-USEPA	Memorandum	73
	7	88/07/13	ACTION MEMORANDUM-Ceiling Increase Request for the Removal Action at the	Valdas Adamkus-USEPA	J.Winston Porter-USEPA	Memorandum	74

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			Midco II Site,Gary,Indiana.				
	3	88/08/01	Review of the FS - Remedial Alternatives Screening.	Charles Suftin-USEPA	Basil Constantelos-USEPA	Memorandum	75
	2	00/00/00	Midwest Region Environmental News.	USEPA		News Release	76
	28	00/00/00	Newspaper articles.			Newspaper Articles	77
	14	00/00/00	Listed Hazarous Waste Disposal At Midco I and Midco II.	Confidential Not available		Other	78
	43	00/00/00	Examination of Marion D. Robinson.			Other	79
	99	80/01/04	Deposition of Charles A. Licht	Charles A. Licht		Other	80
	75	80/01/04	Deposition of Marrin Dale Robinson	Marrin Dale Robinson		Other	81
	94	81/07/28	Deposition of Ernest DeHart.	Ernest DeHart		Other	82
	2	82/11/09	Original Maps by DeHart & Robinson.	DeHart & Robinson		Other	83
	25	85/01/17	Interrogatories Of The Defendant The Penn Central Corp. To The United States Of America along with Request For Production.	Michael Bla[illegible]ain-Wildman,Harrol d.	See service list	Pleadings/Orders	84
	30	85/04/02	Partial Consent Decree.	USEPA	Midco Trustees, et al.	Pleadings/Orders	85
	35	85/08/26	Response To Objections Of The United States To The Interrogatories Of The Defendant Penn Central Corp. To The United States Of America.	Joel Gross et al-U. S. DOJ	See service list	Pleadings/Orders	86
	71	00/00/00	Sample Collection Procedures For Solidification Treatability Study For Midco I and Midco II.	Dames & Moore		Reports/Studies	87

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	4	00/00/00	Documentation of the geology and an assessment of the potential for groundwater pollution.	Karyl Schmidt-ISBH		Reports/Studies	88
	15	79/10/30	Report on Survey at Midco II, 5900 Industrial Highway, Gary, Indiana.	L.E.Townsend-USEPA	Alan Baumann-USEPA	Reports/Studies	89
	1	81/03/09	Report on Survey at Midco II; 5900 Industrial Highway, Gary, Indiana.	Erin Moran-USEPA	Alan Baumann-USEPA	Reports/Studies	90
	29	81/10/00	Aerial Photographic Analysis Of Hazardous Waste Study Sites.	EMSL-USEPA		Reports/Studies	91
	86	84/00/00	Population Survey Of Groundwater Usage In The Vicinity Of Midco II, Gary, Indiana.	CH2M Hill	USEPA	Reports/Studies	92
	410	84/00/00	On-Scene Coordinators Report.	USEPA	CBI removed	Reports/Studies	93
	11	84/11/00	Site Assessment For Moose's Junk Yard.	Weston-Sper TAT	USEPA	Reports/Studies	94
	88	86/12/31	Quality Assurance Project Plan - Survey of Contaminant Levels in Biota Near the Midco I, Midco II and Ninth Avenue Dump Hazardous Waste Sites in Gary, Indiana, Lake County, Indiana.	U.S.Fish & Wildlife Service	USEPA	Reports/Studies	95
	3	88/01/26	Technical Memorandum: Midco II, Round 4 analytical results.	Robert Aten-Geosciences	Roy Ball-ERM	Reports/Studies	96
	[illegible]5	88/03/00	Remedial Investigation Report Appendices G Through I.	ERM	Midco Trustees	Reports/Studies	97
	409	88/03/00	Midco II Remedial Investigation Report	ERM	Midco Trustees	Reports/Studies	98
	465	88/03/00	Remedial Investigation	ERM	Midco Trustees	Reports/Studies	990

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ICHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
			Report Appendices A Through F.				
	278	88/03/00	Remedial Investigation Report Appendices J Through P.	ERM	Midco Trustees	Reports/Studies	100
	129	88/08/00	Quality Assurance Project Plan For Solidification Treatability Study Midco I and Midco II.	Dames & Moore	Midco Trustees	Reports/Studies	101
	46	88/08/24	Health and Safety Plan Solidification Treatability Study Midco I and Midco II.	Dames & Moore		Reports/Studies	102
	11	88/12/01	Health Assessment for the Midco II Site.	ATSDR	USEPA	Reports/Studies	103
	412	89/02/10	Public Comment Feasibility Study	Dames & Moore	Midco Trustees	Reports/Studies	104
	28	89/03/07	Addendum To Public Comment Feasibility Study.	ERM	Midco Trustees	Reports/Studies	105
	15	83/12/08	Review and data package Case #2189, SAS# 825E - Low Water and Medium Soil Metals and Cyanide.	Cynthia Bachunas-Ecol. & Envir.	Clarence Bieze-Ecol&Envir	Sampling/Data	106

GUIDANCE DOCUMENTS : INDEX .
MIDCO I & II SITES, GARY, INDIANA.
Guidance Documents are available for review at
USEPA Region V-Chicago IL

TITLE	AUTHOR	DATE
Guidance on Implementation of the "Contribute to Remedial Performance" Provision.	OSWER Dir. 9360.0-13	87/04/00
Final Guidance for the Coordination of ATSDR Health Assessment Activities with the Superfund Remedial Process.	OSWER Dir. 9285.4-02	87/04/22
Superfund Selection of Remedy: Background Documentaion on Remaining Issues.		87/05/12
Superfund Public Health Evaluation Manual.	OSWER Dir. 9285.4-01	87/07/00
Interim Guidance on Compliance with Applicable or Relevant and Appropiate Requirements. 52 FR 32496 (8/27/87).	OSWER Dir. 9234.0-05	87/07/09
Interim Guidance on PRP's participation in RI/FS.	OSWER Dir. 9835.1a	87/10/02
Interim Guidance on Administrative Records for Decisions on Selection of CERCLA Response Actions.	OSWER Dir. 9833.4	87/11/09
Revised Procedures for Planning and Implementing Off Site Response Actions.	OSWER Dir. 9834.11	87/11/13
FY '88 Region V ROD Process Guidance. Memo from Chief of the Emergency & Remedial Response Branch - Waste Mgmt. Div.	Mary Gade-USEPA	88/01/20
Draft Guidance on Preparing Superfund Decision Documents: The Proposed Plan and ROD.	OSWER Dir. 9355.3-02	88/03/00
Draft Guidance on PRP Participation in the RI/FS.	OSWER Dir. 9835.1A	88/04/00
Record of Decisions Questions & Answers - Draft.		88/04/01
Community Relations During Enforcement Activities and Development of the Administrative Record.	OSWER Dir. 9836.0-1a	88/11/03
Redelegation of Authority Under CERCLA/SARA and Superfund Internal Delegation of Authority.	OSWER Dir. 9012.10	
Quality Assurance Plan For Superfund (Draft).	OSWER Dir. 9200.1-05	
Guidelines for Producing Superfund Documents.	OSWER Dir. 9200.4-01	
Superfund Community Relations Policy.	OSWER Dir. 9230.0-02	

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Community Relations Activities At Superfund Enforcement Sites - Interim Guidance.	OSWER Dir. 9230.0-03A	
Community Relations In Superfund - A Handbook Interim Guidance.	OSWER Dir. 9230.0-03B	
Community Relations Guidance For Evaluating Citizen Concerns At Superfund Sites.	OSWER Dir. 9230.0-04	
CERCLA Compliance With Other Laws Manual Vols. 1-3. (Draft)	OSWER 9234.1-01 to 03	
Interim Guidance On Compliance With Applicable Or Relevant And Appropiate Requirements (ARAR).	OSWER Dir. 9234.0-05	
User's Guide To The Contract Laboratory Program.	OSWER Dir. 9240.0-01	
Analytical Support For Superfund	OSWER Dir. 9240.0-02	
Superfund Analytical Data Revision And Oversight (Draft).	OSWER Dir. 9240.0-03	
REM II Contract Award Fee Performance Evaluation Plan.	OSWER Dir. 9242.3-05	
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Implementation Of The Decentralized Contractor Performance Evaluation And Award Fee Process For Selected Remedial Program Contracts.	OSWER Dir. 9242.3-07	
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Policy On Flood Plains And Wetlands Assessments.	OSWER 9280.0-02	
Recommendations For Groundwater Remediation At The Millcreek, Pennsylvania Site.	OSWER Dir. 9283.1-01	
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Guidance For Conducting Remedial Investigations And Feasibility Studies Under CERCLA (Draft).	OSWER 9335.3-02	
Guidance On Preparing Superfund Decision Documents: The Proposed Plan And Record Of Decision (Draft).	OSWER 9335.3-02	
Participation Of Potentially Responsible Parties (PRPs) In Development Of RIs And FSs.	OSWER 9340.1-01	
Preparation Of Decision Documents For Approving Fund-Financed And PRP Remedial Actions Under CERCLA.	OSWER 9340.2-01	
Preliminary Assessment Guidance, FY-88.	OSWER 9345.1-01	
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USEPA Guidelines For Groundwater Classification Under The EPA Groundwater Protection Strategy.	USEPA	06/12/88

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DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE
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87/00/00	Data Packages, Custody Sheets and Field Notes for data in Biota Study. Available in RPM and CRL files. Region V-Chicago, IL, USEPA.	Hazelton & U.S.Fish & Wildlife	U.S.Fish & Wildlife	Sampling/Data

ACRONYM GUIDE FOR THE ADMINISTRATIVE RECORD
MIDCO I & II SITES
GARY, INDIANA

ACRONYM	DEFINITION
USEPA	United States Environmental Protection Agency
DOJ(USDOJ)	United States Department of Justice
RI	Remedial Investigation
FS	Feasibility Study
IDOH	Indiana Department of Highways
IDEM	Indiana Department of Environmental Management
USDOI	United States Department of Interior
QAPP	Quality Assurance Project Plan
PRP	Potentially Responsible Party
ATSDR	Agency for Toxic Substance and Disease Registry
TAT	Technical Assistance Team
ERM	Environmental Research Management, Inc.
PRC	Planning Research Corporation
E & E	Ecology & Environment, Inc.

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